INTEGRATED ENVIRONMENTAL MONITORING STATUS REPORT FOR SECOND QUARTER 2000

3246

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

SEPTEMBER 2000

U.S. DEPARTMENT OF ENERGY

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AMS	air monitoring station
amsl	above mean sea level
AWWT	Advanced Wastewater Treatment Facility
BRSR	Baseline Remedial Strategy Report
BTV	benchmark toxicity value
DFM	Data Fusion Modeling
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FFCA	Federal Facilities Compliance Agreement
FRL	final remediation level
gpad	gallons per acre per day
gpm	gallons per minute
IEMP	Integrated Environmental Monitoring Plan
lbs	pounds
LCS	leachate collection system
LDS	leak detection system
mg/L	milligrams per liter
M gal	million gallons
mrem	millirem
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
OEPA	Ohio Environmental Protection Agency
OMMP	Operations and Maintenance Master Plan
OSDF	on-site disposal facility
pCi/L	picoCuries per liter
pCi/m³	picoCuries per cubic meter
PRRS	Paddys Run Road Site
TLD	thermoluminescent dosimeter
WPRAP	Waste Pits Remedial Action Project
µg/L	micrograms per liter
µg/m³	micrograms per cubic meter

Introduction

INTEGRATED ENVIRONMENTAL MONITORING STATUS REPORT FOR SECOND QUARTER 2000

The U.S. Department of Energy (DOE) has prepared this report to meet the quarterly reporting obligation defined in the Integrated Environmental Monitoring Plan (IEMP), Revision 1 (DOE 1999a) for the Fernald site. The IEMP quarterly status reports document the results of DOE's ongoing assessment of environmental conditions at and near the site as full-scale remediation of the Fernald site proceeds. The primary objectives of the report are to:

- Provide a summary of key environmental data collected to track and assess the effectiveness of site emission controls
- Provide Fernald stakeholders with a timely assessment of off-property impacts associated with implementation and operation of remedial actions at the Fernald site
- Document the performance of the groundwater remedy for the Great Miami Aquifer
- Document the status of natural resource impacts and restoration activities.

The information presented in the quarterly status report is primarily organized in summary data tables and graphics with minimal textual discussion. This reporting format efficiently summarizes the wide range of environmental and operational data collected each quarter. The data tables and graphical data displays are designed to allow readers to compare the data to historical information and applicable regulatory standards. The information summarized in the quarterly status reports is presented in greater detail in Fernald's annual integrated site environmental report submitted June 1 of each year.

The next IEMP quarterly status report will be submitted in December of 2000. It is anticipated that the December report will be the final quarterly status report submitted under the current IEMP reporting format. Initial discussions internally and with the Ohio Environmental Protection Agency (OEPA) will result in a more streamlined and timely format for reporting IEMP data. Details of the revised reporting format will be presented in Revision 2 of the IEMP, which will be submitted to the Environmental Protection Agency (EPA) and OEPA in October of 2000. The revised reporting format will go into effect upon EPA and OEPA approval of the IEMP, Revision 2.

Groundwater Remedy

1.0 GROUNDWATER REMEDY

This section summarizes the second quarter 2000 operational data for the aquifer remedy and the first quarter 2000 analytical data from groundwater monitoring. The material in this section satisfies the groundwater reporting requirements presented in the Integrated Environmental Monitoring Plan (IEMP), Revision 1 (DOE 1999a).

Figure 1-1 shows the sampling activities that contributed data to this section. Figure 1-2 identifies the IEMP groundwater extraction and monitoring wells by module/monitoring activity and Figure 1-3 shows the IEMP water level (groundwater elevation) monitoring wells. Figure 1-4 shows the location of the active aquifer restoration modules and extraction/re-injection wells.

Figure 1-1 also shows the groundwater monitoring activities to be summarized in the next IEMP quarterly status report to be submitted in December of 2000. The report will contain operational data and the plume capture assessment from July through September 2000 (third quarter) and analytical results from the groundwater sampling activities conducted from April through June 2000 (second quarter).

1.1 OPERATIONAL ASSESSMENT

1.1.1 AQUIFER RESTORATION SYSTEM SUMMARY

Table 1-1 summarizes the operational data from the three active restoration modules for the second quarter of 2000. The South Plume and South Field (Phase I) Extraction Modules pumped a total of 448.483 million gallons of groundwater and removed 208.29 pounds of uranium during this reporting period. The Re-Injection Demonstration Module re-injected 64.062 million gallons of treated groundwater back into the aquifer for a net total extraction of 384.421 million gallons. To date, 5.817 billion gallons of groundwater have been pumped and 1,933.38 pounds of uranium have been removed from the aquifer. During the second quarter of 2000, re-injection returned 2.96 pounds of uranium back into the aquifer. Figure 1-5 depicts the total groundwater pumped versus groundwater treated during the second quarter of 2000. Figure 1-6 shows the uranium removal indices for the South Field (Phase I) Extraction and South Plume Modules.

1.1.2 MODULE-SPECIFIC SUMMARIES

1.1.2.1 SOUTH FIELD (PHASE I) EXTRACTION MODULE

The module target pumping rate for the 11 active extraction wells was 1,900 gallons per minute (gpm). For the majority of the period, all active extraction wells in the module were pumped at or above the rates specified in the Baseline Remedial Strategy Report, Remedial Design for Aquifer Restoration (Task 1) (DOE 1997a).

As reported in the 1999 Integrated Site Environmental Report (DOE 2000a), sampling was to continue at Extraction Well 31566 as soon as a smaller pump was installed in the well. In April of 2000 the U.S. Department of Energy (DOE) installed a new pump in Extraction Well 31566 and sampling resumed for total uranium on a monthly basis. As shown in Figure 1-18, the uranium concentrations at Extraction Well 31566 remain far below the groundwater final remediation level (FRL) of 20 micrograms per liter (µg/L).

Pumping rates were significantly lower in May of 2000 at Extraction Wells 31550, 31560, 31561, 31563, and 31567. This decrease occurred as a result of decreased groundwater treatment capacity in the Advanced Wastewater Treatment Facility 1800 system, which was off line while resin leakage from the ion exchange vessels was being investigated (refer to the Re-injection Demonstration Section of this report). To help compensate for well downtimes (due to maintenance, electrical outages, etc.), pumping rates of all nine operating original extraction wells (not including Extraction Well 31566) were increased by 10 percent from June 20, 2000, through the end of the second quarter. The opportunity to increase the pumping rates was made available by higher than average groundwater treatment capacity and lower than normal uranium concentrations in the site effluent (concentrations measured at the Parshall Flume [PF 4001]) to the Great Miami River. The pumping rate increases may continue depending on the available treatment capacity and uranium concentrations in site effluent.

Table 1-2 provides operational details for this module. Daily pumping rate figures, which identify operational percentages for each well and outages lasting longer than 24 hours, can be viewed by going to Table 1-2 and selecting the appropriate well number. Figure 1-18 provides the weekly total uranium concentrations for each extraction well in this module.

1.1.2.2 SOUTH PLUME MODULE

The South Plume Module target pumping rate was 2,000 gpm. For the majority of the period, the six wells (Figure 1-4) were pumped at or above the rates specified in the Baseline Remedial Strategy Report. The monthly average pumping rates for Extraction Wells 32308 and 32309 were significantly lower in May and June than in April due to the precepts in the Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Project (DOE 1999b). The Operations and Maintenance Master Plan states that Extraction Wells 32308 and 32309, whose concentrations are generally higher than those of the original South Plume extraction wells, must be shut down when the re-injection wells are off line. To help compensate for well downtimes (due to maintenance, electrical outages, etc.), pumping rates of Extraction Wells 32308 and 32309 were increased by 20 percent from June 20, 2000, through the end of the second quarter. The opportunity to increase the pumping rates was made available by higher than average groundwater treatment capacity and lower than normal uranium concentrations in the site effluent (concentrations measured at the Parshall Flume [PF 4001]). The pumping rate increases may continue depending on the available treatment capacity and uranium concentrations in site effluent.

Table 1-3 provides operational details for the South Plume Module. Daily pumping rate figures, which identify operational percentages for each well and outages lasting longer than 24 hours, can be viewed by going to Table 1-3 and selecting the appropriate well number. Figure 1-25 depicts the weekly total uranium concentrations for each well in this module.

1.1.2.3 RE-INJECTION DEMONSTRATION MODULE

The target re-injection rate for this module as specified in the Baseline Remedial Strategy Report was 1,000 gpm. Due to several system shut downs, the target rate was not consistently maintained throughout the quarter (Figure 1-4). The most significant re-injection system shut down was in May due to shut down of the treatment facility that supplies the injectate. Approximately two cups of Dowex 21K ion exchange resin were found in sediments removed from the sump of Re-Injection Well 22107 on May 8, 2000, resulting in the shut down of the injectate treatment facility and the remaining injection wells. On May 17, 2000 tests of the ion exchange vessels were completed to determine which vessel produced the resin. A failure of an effluent strainer in the manifold of ion exchange vessel 3B was determined to be the cause of the resin leakage. Repairs were finished on June 2, 2000 and vessel 3B, along with the rest of the injectate treatment system, was returned to service later that afternoon. Re-injection resumed as of second shift on June 6, 2000. The re-injection surge tank was also drained and any resin found in the bottom of the tank was removed. Resin clean out of the remaining re-injection wells and the effluent aeration tank, located near the Parshall Flume, is to be completed by November 2000.

The total uranium concentration trended upward in the injectate source water during the second quarter of 2000 (Figure 1-31). Note that Figure 1-31 presents a non-continuous data set as re-injection was not occurring continuously throughout the quarter. On May 1, 2000 the injectate concentration exceeded the 20 µg/L total uranium concentration limit. As reported in the May 2000 Monthly Re-injection Operating Report, the total uranium composite sample for May 1 was 20.3 µg/L. The total uranium grab sample result from this same date was 22.7 µg/L. On May 2, 2000 DOE temporarily discontinued re-injection operations and notified the U.S. Environmental Protection Agency (EPA) and Ohio Environmental Protection Agency (OEPA) verbally of the shutdown due to this total uranium exceedance. Figure 1-31 provides explanations for system shut downs. At the close of the quarter, the injectate total uranium concentration was about 5 µg/L, well below the Fernald Environmental Management Project administrative action level of 10 µg/L. Daily re-injection rate figures, which identify operational percentages for each well and outages lasting longer than 24 hours, can be viewed by going to Table 1-4 and selecting the appropriate well number.

1.2 AQUIFER CONDITIONS

1.2.1 URANIUM PLUME

1.2.1.1 TOTAL URANIUM PLUME

Figure 1-32 depicts the total uranium plume contours for first quarter 2000. The plume contours were revised using first quarter data in the following locations: Monitoring Well 2900, in the South Plume; Monitoring Well 2033, in the waste pit area; and Monitoring Well 3068, in the northeastern edge of the South Field. As detailed below, the contours were not changed in the vicinity of Monitoring Well 2546. In addition, several wells (KC-2 Warehouse well and Monitoring Wells 2033, 2034, 2551, 3034, and 3551) were plugged and abandoned in April of 2000, necessitating pre-plugging sampling at each location for total uranium. Additionally, as mentioned in the Integrated Environmental Monitoring Status Report for First Quarter 2000 (DOE 2000b), modifications to the uranium plume contours in the waste storage area were made according to data compiled in the Conceptual Design for Remediation of the Great Miami Aquifer in the Waste Storage and Plant 6 Areas. Also note that the total uranium concentration at Monitoring Well 2552 decreased from 33.0 to 18.0 µg/L. A discussion of each of the wells that resulted in a change to the uranium contours on Figure 1-32 is provided below.

Monitoring Well 2900

The first quarter 2000 total uranium concentration at Monitoring Well 2900 was 21.0 µg/L, with a presampling turbidity result of 999 nephelometric turbidity units (NTU). Despite the high turbidity, as indicated in Figure A.2-78 of the 1999 Integrated Site Environmental Report, the total uranium concentration at this well has trended upward since 1993. DOE will schedule this well for redevelopment to hopefully reduce the turbidity in samples collected from this well.

Monitoring Well 2033

The first quarter 2000 total uranium concentration at Monitoring Well 2033 was 80.9 µg/L, with a presampling turbidity result of 0 NTU. Elevated concentrations at this well had previously been discounted due to high turbidity, but the lack of turbidity in the March 2000 sample provides reason for drawing the 50 µg/L contour around this location in one of the new waste storage area plumes as shown on Figure 1-32. Note that this well has been plugged and abandoned to facilitate construction activities in the Silos Project area.

Monitoring Well 3068

The first quarter 2000 total uranium concentration at Monitoring Well 3068 was 64.2 µg/L. This required the boundary of the 20 and 50 µg/L contours to be shifted to encompass this well. The fourth quarter 1999 total uranium concentration of 50.7 µg/L at this well, sampled on December 28, 1999, was discounted during the process of revising the plume map for fourth quarter 1999. The reason for discounting the December 1999 sample was because all previous sampling of the well indicated uranium concentrations of less than 5 µg/L in the well (refer to Figure A.2-90 of the 1999 Integrated Site

Environmental Report). The June 2000 preliminary total uranium concentration of 101 µg/L also confirmed the increasing trend in uranium concentrations at Monitoring Well 3068. This continued increase in June further underscores the need to extend the uranium plume contours to encompass this well.

In July 2000 surface water infiltration into Monitoring Well 3068 was ruled out as the source of increasing uranium. It was thought that surface water noted on the well pad at the flush mounted cap could have entered the well and caused the recent spate of higher total uranium concentrations. Other possible sources included the Storm Water Retention Basin, the Storm Sewer Outfall Ditch, and the ditch east of the wells. Samples from the ditch east of the wells were found to be low (i.e., below the FRL) in total uranium concentration.

Although groundwater modeling indicates this newly defined portion of the plume is still within the capture zone of existing South Field Extraction Well 31562, it is recognized that additional extraction wells may be required to remediate this portion of the plume within the current schedule. Additional extraction wells are planned for Phase II of the South Field extraction system, which is scheduled to commence operation in October 2003. The pre-design monitoring for Phase II is scheduled to begin in 2001. The current findings along with those of the pre-design monitoring will be factored into the Phase II design for this newly defined area of contamination. Concentrations at and in the vicinity of Monitoring Well 3068 will continue to be tracked and reported in future IEMP reports.

Monitoring Well 2546

The first quarter 2000 total uranium concentration at Monitoring Well 2546 was 178.0 µg/L, with a presampling turbidity result of >999 NTU. This well lies southwest of the South Plume Module and south of the 10-year, uranium-based restoration footprint. In May of 2000 both an unfiltered and a filtered groundwater sample were collected. The unfiltered sample had a total uranium concentration of 40 µg/L and a turbidity result of >999 NTU. The filtered sample (0.45-micron filter) had a total uranium concentration of 0.457 µg/L. The two orders of magnitude concentration difference between the filtered and unfiltered sample indicates that turbidity is an issue at this well. The continued sampling of this well will be reevaluated as part of the upcoming IEMP revision.

1.2.2 GROUNDWATER ELEVATIONS AND CAPTURE ASSESSMENT

1.2.2.1 GROUNDWATER ELEVATIONS AND CAPTURE ASSESSMENT

Groundwater elevation measurements for the second quarter of 2000 were collected from April 17 through April 24, 2000. The Type 2 measurements are contoured in Figure 1-33. The figure also contains some Type 6 measurements (Type 6 wells are screened at a slightly deeper interval than Type 2 wells), which are posted to achieve better lateral coverage across the map area. Actual pumping rates for each module from April 17 through April 24 are posted on the figure to document the pumping conditions on these dates.

Past experience at the Fernald site has shown that with a large number of wells (approximately 180) being measured each quarter, some measurement, transcription, or data entry errors occur (typically less than five percent). These errors often become apparent when the data are posted to maps and the contouring process begins. When the errors are identified, the erroneous data points are removed from the data set to be contoured in order to produce a water level map that represents aquifer conditions. Water level measurements in four monitoring wells were not used in the April data set because the measurements were inconsistent with other wells in their respective areas. The inconsistent measurements were observed in Monitoring Wells 2649 (535.8 feet above mean sea level [amsl]), 2108 (531.8 feet amsl), 2091 (517.5 feet amsl), and 2399 (519.3 feet amsl).

Capture of the main portion of the South Plume (north of Paddys Run Road Site [PRRS] above the 20 µg/L total uranium FRL) continued during the second quarter of 2000 due to pumping in the South Plume Module (refer to Figure 1-34). This figure shows the predicted steady state groundwater elevations based on the VAM3D groundwater flow model with the South Field (Phase I) Extraction, Re-Injection Demonstration, and South Plume Modules operating as specified in the Baseline Remedial Strategy Report. For comparative purposes, the 10-year, uranium-based restoration footprint (capture zone), the maximum total uranium plume outline (updated with first quarter 2000 data), and the interpreted capture zones from the groundwater elevation map (Figure 1-33) are also shown on the figure. Note that the modeled capture zone and the capture zone derived from the April water level measurements appear to be in good agreement.

1.2.2.2 SOUTH PLUME ADMINISTRATIVE BOUNDARY

Table 1-5 presents results of the first quarter 2000 PRRS constituent samples for arsenic, phosphorus, potassium, and sodium. No volatile organic compounds were detected in first quarter 2000 in the wells used for monitoring PRRS constituents. Results were generally lower than the historical averages. However, the arsenic and phosphorus concentrations at Monitoring Wells 2898 and 2900 were new maximum concentrations for these locations. Potassium was also at its maximum in Monitoring Well 2898. In reviewing the first quarter data for these two locations it was noted that the turbidity result of the samples was > 999 NTU. Preliminary results from the second quarter sampling event in May 2000 indicated the arsenic results were nondetected for both wells along with lower turbidity readings in both wells (140 NTU for Monitoring Well 2900 and 139 NTU for Monitoring Well 2898). Therefore, the unusually high first quarter results are being attributed to the high turbidity of the samples.

1.2.2.3 GROUNDWATER MODEL

The groundwater flow model has been successfully recalibrated to an October 1998 groundwater elevation data set and has been validated against three other quarterly elevation data sets (April 1998, June 1999, and October 1999). The re-calibration effort has been completed and the results are in the Great Miami Aquifer VAM3D Flow Model Re-calibration Report (DOE 2000d) which was submitted to EPA and OEPA in May 2000.

Phase II of the groundwater model upgrade project, which incorporates data fusion technology into the groundwater transport model has been completed. The information on this effort is provided in the Integration of Data Fusion Modeling (DFM) with VAM3DF Contaminant Transport Code Report (DOE 2000c) which was received from HydroGeoLogic, Inc. in April, and provided to EPA and OEPA in May 2000. Data fusion, when coupled with the contaminant transport code, provides a mechanism to allow the model to set transport parameters within pre-determined ranges to best match observed field data, thereby improving model predictions. Model output from data fusion also provides a quantitative measure of model uncertainty.

DOE is planning an evaluation and application phase for the DFM code, which will begin during the summer of 2000. The DFM code will not be used for decisions affecting the performance or design of the aquifer remedy until the evaluation and application activity has been completed and reviewed by EPA and OEPA.

Phase III of the groundwater model upgrade project, which consists of an optimization package, will not be started until the DFM code evaluation and application activity has been completed. When completed, it is anticipated that Phase III of the model upgrade will provide a decision support system to optimize extraction/re-injection well locations and pumping rates for the aquifer remedy.

A meeting with EPA and OEPA was held on July 11, 2000, to discuss the two modeling reports. OEPA comments on the reports have been received and DOE is currently formulating comment responses.

1.2.3 KC-2 WAREHOUSE WELL MONITORING

As reported in the 1999 Integrated Site Environmental Report and as identified in DOE Letter No. 0087-00, dated November 1, 1999, which transmitted changes to the IEMP to EPA and OEPA, the KC-2 Warehouse well (Well 67) has been removed from the IEMP sampling program. Well 67 was plugged and abandoned on April 13, 2000. Prior to plugging and abandonment, the well was sampled in March of 2000. Table 1-6 presents these data. Results were generally lower than the historical averages. Although cyanide and sodium concentrations exceeded the historical average, there is no groundwater FRL for either constituent. This section will be eliminated in future IEMP reports due to the well being plugged and abandoned.

TABLE 1-1

AQUIFER RESTORATION SYSTEM OPERATIONAL SUMMARY SHEET

	Reporting Period					
	April 2000 through June 2000			August 1993 through June 2000		
	Gallons Pumped/Re-Injected (M gal)	Total Uranium Removed/Re-Injected (lbs)	Uranium Removal Index[a] (lbs/M gal)	Gallons Pumped/Re-injected (M gal)	Total Uranium Removed/Re-Injected (lbs)	Uranium Removal Index[a] (lbs/M gal)
South Field (Phase I) Extraction Module	224.959	158.78	0.71	1,558.159	1,014.45	0.65
South Plume Module	223.524	49.51	0.22	5,010.340	952.12	0.19
Re-Injection Demonstration Module	64.062	2.96	NA	751.741	33.19	NA
Aquifer Restoration Systems Totals						
(Extraction Wells)	448.483	208.29	0.46	6,568.499	1,966.57	0.30
(Re-Injection Wells)	64.062	2.96	NA	751.741	33.19	NA
(net)	384.421	205.33	NA	5,816.758	1,933.38	NA

[a]NA = not applicable

TABLE 1-2

**SOUTH FIELD (PHASE I) EXTRACTION MODULE
OPERATIONAL SUMMARY SHEET FOR SECOND QUARTER
(APRIL 2000 THROUGH JUNE 2000)**

Extraction Well	31565	31564	31566[a,b]	31563	31567	31550	31560	31561	31562	32276	32447	32446
	Baseline Remedial Strategy Report Target Pumping Rates (gpm)											
	200	200	200	200	100	100	100	100	100	200	200	200
	Average Pumping Rates (gpm)											
April	209	201	NA	208	99	100	97	99	199	288	200	200
May	172	173	NA	114	67	59	58	57	120	230	178	179
June	200	202	NA	200	144	101	100	101	139	299	200	201
Quarterly Average	194	192	NA	174	103	87	85	86	153	272	193	193
	Average Total Uranium Concentrations (µg/L)											
April	10.1	13.0	8.4	25.9	34.5	56.5	78.7	40.1	104.7	140.5	237.8	122.8
May	12.2	13.4	7.8	26.9	36.8	52.3	64.3	47.2	119.7	136.9	218.9	105.9
June	10.5	12.9	8:6	25.6	41.3	54.3	74.5	42.2	119.2	139.8	208.6	113.7
Quarterly Average	11.0	13.1	8.3	26.1	37.5	54.4	72.5	43.2	114.5	139.1	221.8	114.1
	Uranium Removal Index (Pounds of Total Uranium Removed/Million Gallons Pumped)											
April	0.08	0.11	NA	0.22	0.29	0.47	0.66	0.33	0.87	1.17	1.98	1.02
May	0.10	0.11	NA	0.22	0.31	0.44	0.54	0.39	1.00	1.14	1.83	0.88
June	0.09	0.11	NA	0.21	0.34	0.45	0.62	0.35	0.99	1.17	1.74	0.95
Quarterly Average	0.09	0.11	NA	0.22	0.31	0.45	0.61	0.36	0.95	1.16	1.85	0.95

	Average Module Pumping Rate (gpm)	Water Pumped by Module (M gal)	Total Uranium Concentration from Module[c] (µg/L)
April	1,900	81.953	86.3
May	1,407	61.408	87.5
June	1,887	81.598	80.4
Quarterly Average	1,731	Total 224.959	Quarterly Average 84.7

[a]NA = not applicable; NS = not sampled
[b]Monthly sampling for total uranium resumed in May of 2000.
[c]Average is calculated from individual well total uranium concentrations and flow rates.

TABLE 1-3

SOUTH PLUME MODULE
OPERATIONAL SUMMARY SHEET FOR SECOND QUARTER
(APRIL 2000 THROUGH JUNE 2000)

Extraction Well	3924	3925	3926	3927	32308	32309
	Baseline Remedial Strategy Report Target Pumping Rates (gpm)					
	300	300	400	400	250	250
	Average Pumping Rates (gpm)					
April	285	298	382	485	230	230
May	290	278	359	468	40	40
June	299	320	402	477	182	182
Quarterly Average	291	299	381	477	151	151
	Average Total Uranium Concentrations (µg/L)					
April	34.3	33.8	25.1	2.1	67.3	59.6
May	28.6	33.1	26.0	4.0	60.5	50.7
June	29.2	29.2	23.3	2.1	73.1	64.8
Quarterly Average	30.7	32.0	24.8	2.7	66.9	58.4
	Uranium Removal Index (Pounds of Total Uranium Removed/Million Gallons Pumped)					
April	0.29	0.28	0.21	0.02	0.56	0.50
May	0.24	0.28	0.22	0.03	0.50	0.42
June	0.24	0.24	0.19	0.02	0.61	0.54
Quarterly Average	0.26	0.27	0.21	0.02	0.56	0.49

	Average Module Pumping Rate (gpm)	Water Pumped by Module (M gal)	Total Uranium Concentration from Module[a] (µg/L)
April	1,911	82.390	30.60
May	1,467	64.518	22.13
June	1,861	76.616	25.80
Quarterly Average	1,746	Total 223.524	Quarterly Average 26.18

[a]Average is calculated from individual well total uranium concentrations and flow rates.

TABLE 1-4

RE-INJECTION DEMONSTRATION MODULE
OPERATIONAL SUMMARY SHEET FOR SECOND QUARTER
(APRIL 2000 THROUGH JUNE 2000)

Re-Injection Well	22107	22108	22109	22240	22111
	Baseline Remedial Strategy Report Target Re-Injection Rates (gpm)				
	200	200	200	200	200
	Average Re-Injection Rates (gpm)				
April	95	175	173	174	174
May	0	32	32	32	32
June	132	134	29	134	134
Quarterly Average	75.7	114	78	113	113

	Average Module Re-Injection Rate (gpm)	Water Re-Injected By Module (M gal)	Total Uranium Concentration from Module (µg/L)
April	791	34.122	4.66
May	128	5.714	4.65
June	561	24.226	6.96
Quarterly Average	493	Total 64.062	Quarterly Average 5.42

TABLE 1-5

PADDYS RUN ROAD SITE GROUNDWATER SUMMARY STATISTICS

		Sampling Period						
		January 1, 1988 through March 31, 2000					Sample Results for First Quarter 2000	
Constituent	Monitoring Well	Number of Samples[a,b,c]	Min.[a,b,c,d] (mg/L)	Max.[a,b,c,d] (mg/L)	Avg.[a,b,c,d] (mg/L)	SD[a,b,c,d] (mg/L)	Sample Result (mg/L)[e]	Validation Qualifier[f,g]
Arsenic	2128	212	0.000195	0.1876	0.0125	0.0220	0.00039	U
	2625	199	0.0048	0.05	0.012	0.008	NS	NA
	2636	171	0.01	0.0939	0.04	0.02	NS	NA
	2898	27	0.00035	0.082	0.0045	0.016	0.082	J
	2899	25	0.00032	0.0032	0.0013	0.00082	NS	-
	2900	209	0.00032	0.0609	0.0053	0.0064	0.0609	J
	3128	30	0.00085	0.234	0.011	0.042	0.0057	-
	3636	29	0.0006	0.014	0.002	0.0024	0.002	U J
	3898	27	0.0006	0.0062	0.002	0.0012	0.0035	-
	3899	28	0.00032	0.003	0.0013	0.0008	0.0024	U
	3900	28	0.000395	0.0045	0.0024	0.0010	0.0029	-
Phosphorus	2128	38	0.04	16.2	2	3	0.28	-
	2625	24	0.307	12.3	3.38	3.24	NS	NA
	2636	23	9.6	170	95	50	NS	NA
	2898	28	0.005	1.7	0.1	0.4	1.7	-
	2899	24	0.005	0.11	0.04	0.03	NS	NA
	2900	26	0.07	4.74	0.6	0.9	4.74	J
	3128	37	0.005	13	0.4	2	0.06	U
	3636	28	0.00955	1.1	0.1	0.2	0.02	U
	3898	26	0.00955	1.24	0.12	0.24	0.07	U
	3899	27	0.00955	0.83	0.12	0.17	0.02	U
	3900	28	0.005	1.26	0.1	0.2	0.02	U
Potassium	2128	30	0.83	18	3.9	4.5	1.66	-
	2625	24	0.64	6.26	3.4	1.7	NS	NA
	2636	23	8.51	218	82.4	54.7	NS	NA
	2898	28	1.11	7.78	3.79	1.11	7.78	-
	2899	25	1.36	4.66	3.57	0.626	NS	NA
	2900	27	0.0095	6	1.9	1.3	4.76	J
	3128	30	1.085	3.7	2.4	0.66	1.82	-
	3636	28	1.09	4.24	2.50	0.608	1.59	J
	3898	27	0.61	3.93	2.3	0.68	2.57	-
	3899	28	0.875	3.22	2.4	0.43	2.4	-
	3900	28	0.975	3.19	1.87	0.509	1.79	-
Sodium	2128	30	22.9	75.2	38	13	23	-
	2625	24	16.5	50.7	33.8	7.88	NS	NA
	2636	23	23	79.9	47	16	NS	NA
	2898	28	4.945	29.2	18.1	4.72	17.7	-
	2899	25	11.2	22.9	17.0	3.16	NS	-
	2900	27	0.01355	43.3	29	9.7	18.8	-
	3128	30	3.56	13.4	6.51	3.30	3.85	-
	3636	28	3.98	13	7.7	3.0	4.33	-
	3898	27	7.29	14.6	9.4	1.9	14	-
	3899	28	6.24	12.1	8.60	1.42	7.17	-
	3900	28	3.56	10.8	6.09	1.92	3.89	-

[a]The data are based on unfiltered samples from the Operable Unit 5 remedial investigation/feasibility study data set (1988 through 1993) and 1994 through 2000 groundwater data.
[b]If more than one sample is collected per well per day (e.g., duplicate), then only one sample is counted for the total number of samples, and the sample with the maximum concentration is used to determine the summary statistics (minimum, maximum, average, and standard deviation [SD]).
[c]Rejected data qualified with either a R or Z were not included in this count or the summary statistics.
[d]Where concentrations are below the detection limit, each result used in the summary statistics is set at half the detection limit.
[e]NS = not sampled due to well being dry.
[f]Validation qualifier codes are provided in Appendix D of the Sitewide CERCLA Quality Assurance Project Plan (DOE 1998).
[g]NA = not applicable

TABLE 1 -6
KC-2 WAREHOUSE WELL 67 SUMMARY STATISTICS
(January 1993 through First Quarter [March] 2000)

Constituent	Number of Samples[a,b]	FRL[c] (mg/L)	Min.[a,b,d] (mg/L)	Max.[a,b,d] (mg/L)	Avg.[a,b,d] (mg/L)	SD[a,b,d] (mg/L)	2000 Data Sample Result (mg/L); Validation Qualifier[e]
Aluminum	14	NA	0.0104	80	12	24	0.103 -
Antimony	14	0.0060	0.000065	0.22	0.045	0.068	0.00162 -
Arsenic	14	0.050	0.00041	0.0873	0.014	0.029	0.000851 U
Barium	14	2.0	0.103	0.867	0.336	0.246	0.153 -
Beryllium	14	0.0040	0.0000065	0.005	0.0012	0.0016	0.000013 U
Cadmium	14	0.014	0.00003	0.0671	0.01	0.02	0.00013 U
Calcium	14	NA	45.3	1310	300	422	63.4 -
Chromium	14	0.022[f]	0.000415	2.35	0.372	0.720	0.00178 U
Cobalt	14	0.17	0.000065	0.102	0.022	0.036	0.000451 -
Copper	14	1.3	0.000335	0.373	0.0825	0.138	0.00282 U
Cyanide	6	NA	0.000985	0.005	0.003	0.0018	0.01 UJ
Iron	14	NA	1.65	620	130	219	5.99 J
Lead	14	0.015	0.00026	3.8	0.68	1.3	0.00959 -
Magnesium	14	NA	31.4	322	93.6	99.9	31.4 -
Manganese	14	0.900	0.0363	8.52	1.8	2.9	0.16 -
Mercury	14	0.0020	0.00002	0.0022	0.0003	0.0006	0.00004 U
Nickel	14	0.10	0.00039	1.21	0.21	0.38	0.00297 -
Potassium	13	NA	0.922	14.6	3.05	3.83	2.53 -
Selenium	14	0.050	0.00039	0.0099	0.0025	0.0027	0.00121 U
Silver	14	0.050	0.0000505	0.0312	0.00476	0.00853	0.000101 U
Sodium	13	NA	17.5	32	21	3.7	32 -
Thallium	14	NA	0.000025	1.8	0.13	0.48	0.000324 -
Vanadium	14	0.038	0.000075	0.19	0.033	0.053	0.000879 U
Zinc	14	0.021	0.0061	1.79	0.34	0.55	0.0188 -
		(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Uranium, Total	14	20	0.04	2400	180	600	1.3904 -

[a]If more than one sample is collected per well per day (e.g., duplicate), then only one sample is counted for the total number of samples, and the sample with the maximum concentration is used to determine the summary statistics (minimum, maximum, average, and standard deviation [SD]).
[b]Rejected data qualified with either a R or Z were not included in this count or the summary statistics.
[c]NA = not applicable
[d]Where concentrations are below the detection limit, each result used in the summary statistics is set at half the detection limit.
[e]Validation qualifier codes are provided in Appendix D of the Sitewide CERCLA Quality Assurance Project Plan.
[f]The FRL is based on chromium VI, from Operable Unit 5 Record of Decision, Table 9 -4; however, the sampling results are for total chromium.

FIGURE 1-1

GROUNDWATER SAMPLING ACTIVITIES

SAMPLING ACTIVITIES	Quarter/Year											
	First Quarter/2000			Second Quarter/2000			Third Quarter/2000			Fourth Quarter/2000		
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
South Plume Module:												
Operational				●	◆	●	☒	☒	☒			
Aquifer Conditions		◆			☒							
South Field Extraction Module:												
Operational (Phase 1)				◆	◆	◆	☒	☒	☒			
Aquifer Conditions			◆			☒						
Re-Injection Demonstration Module[a]												
Operational				◆	◆	◆	☒	☒	☒			
Waste Storage Area Module:												
Pre-Design Monitoring												
Aquifer Conditions						☒						
Plant 6 Area Module:												
Pre-Design Monitoring												
Aquifer Conditions						☒						
Routine Water-Level/Flow Direction Monitoring				◆			☒					
Property Boundary Monitoring	◆			☒								
Private Well Monitoring	●			☒								
KC-2 Warehouse Well Monitoring[b]			◆									

● Data summarized/evaluated in this report
☒ Data summarized/evaluated in the next report

FINAL

[a]Aquifer conditions for this module are being addressed in the Re-Injection Demonstration Report.
[b]The final sampling event at the KC-2 Warehouse well was conducted in March of 2000 due to dismantling of the KC-2 Warehouse and subsequent plugging and abandonment of the well.

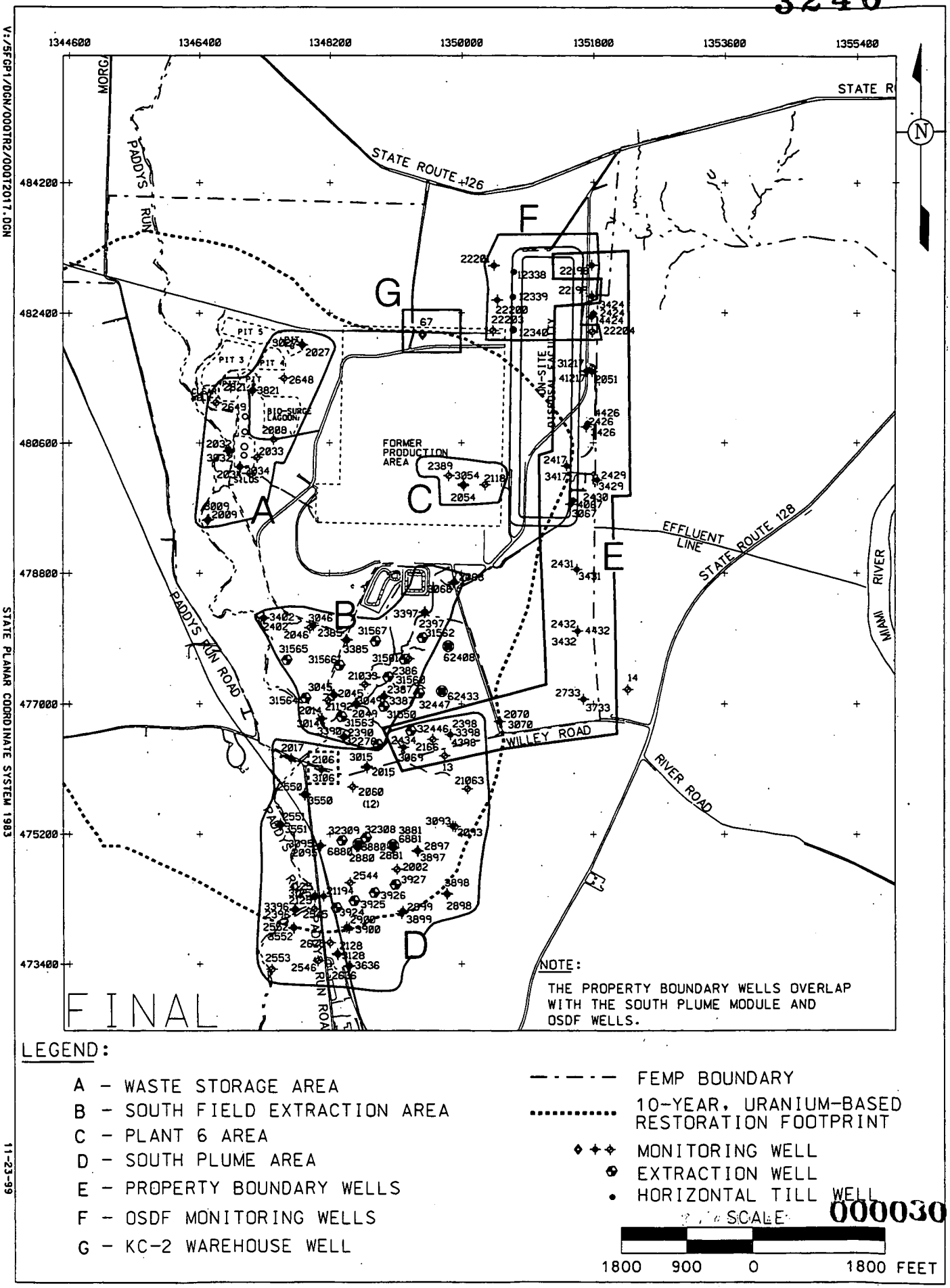


FIGURE 1-2. IEMP WATER QUALITY MONITORING WELLS AND EXTRACTION WELLS

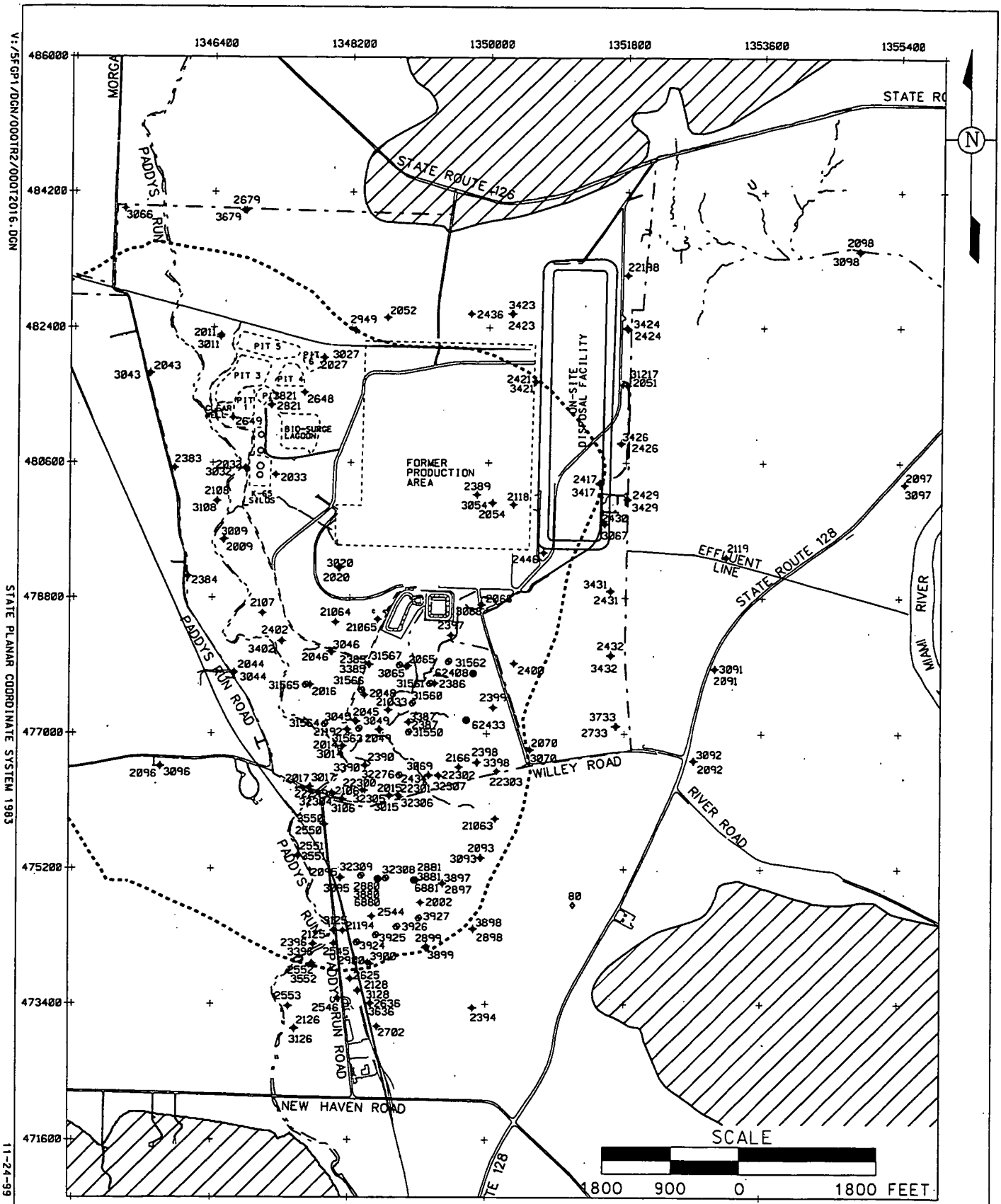
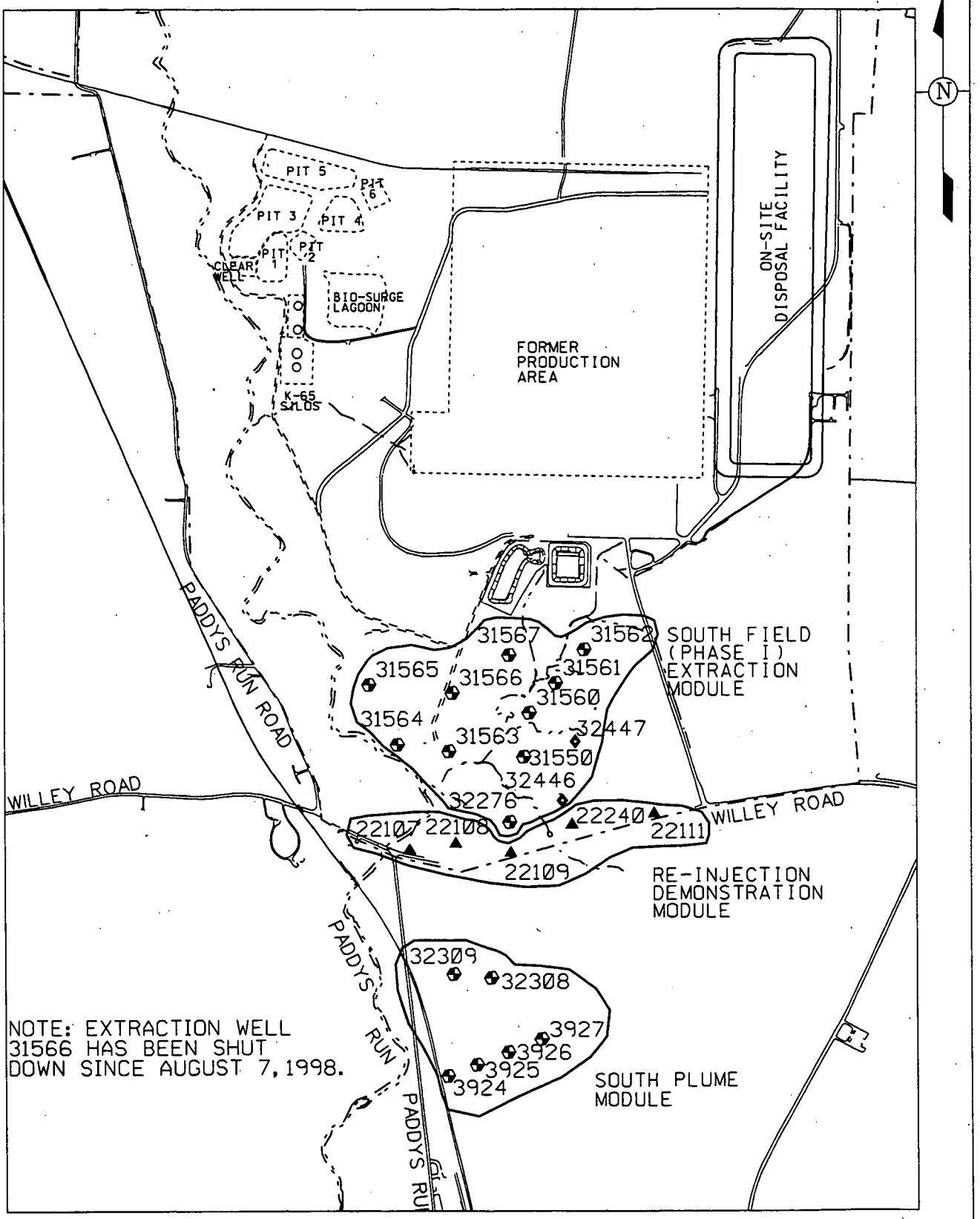


FIGURE 1-3. GROUNDWATER ELEVATION MONITORING WELLS



FINAL

FIGURE 1-4. LOCATION OF ACTIVE AQUIFER RESTORATION MODULES

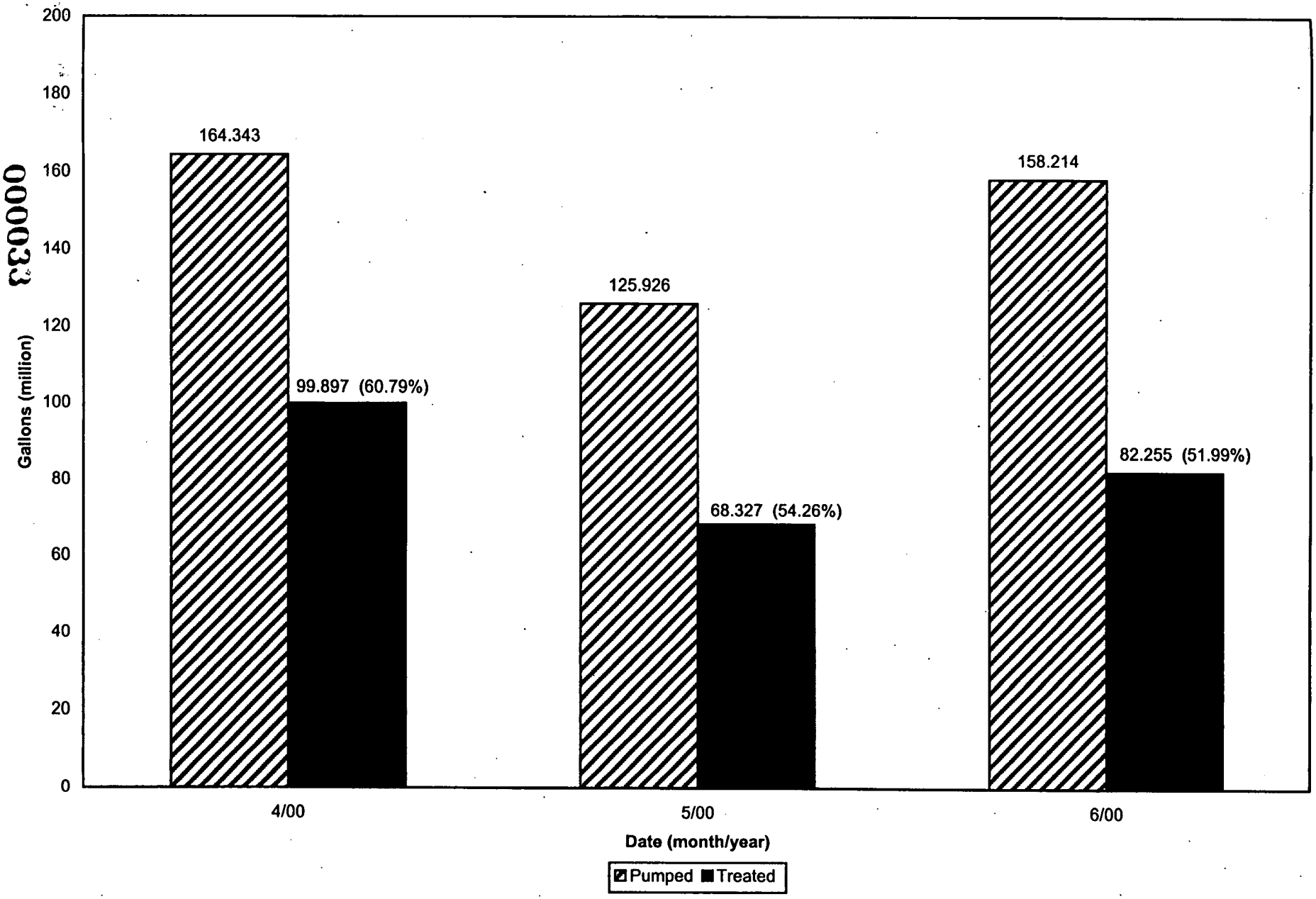


FIGURE 1-5. TOTAL GROUNDWATER PUMPED VS. GROUNDWATER TREATED FOR SECOND QUARTER 2000

FINAL

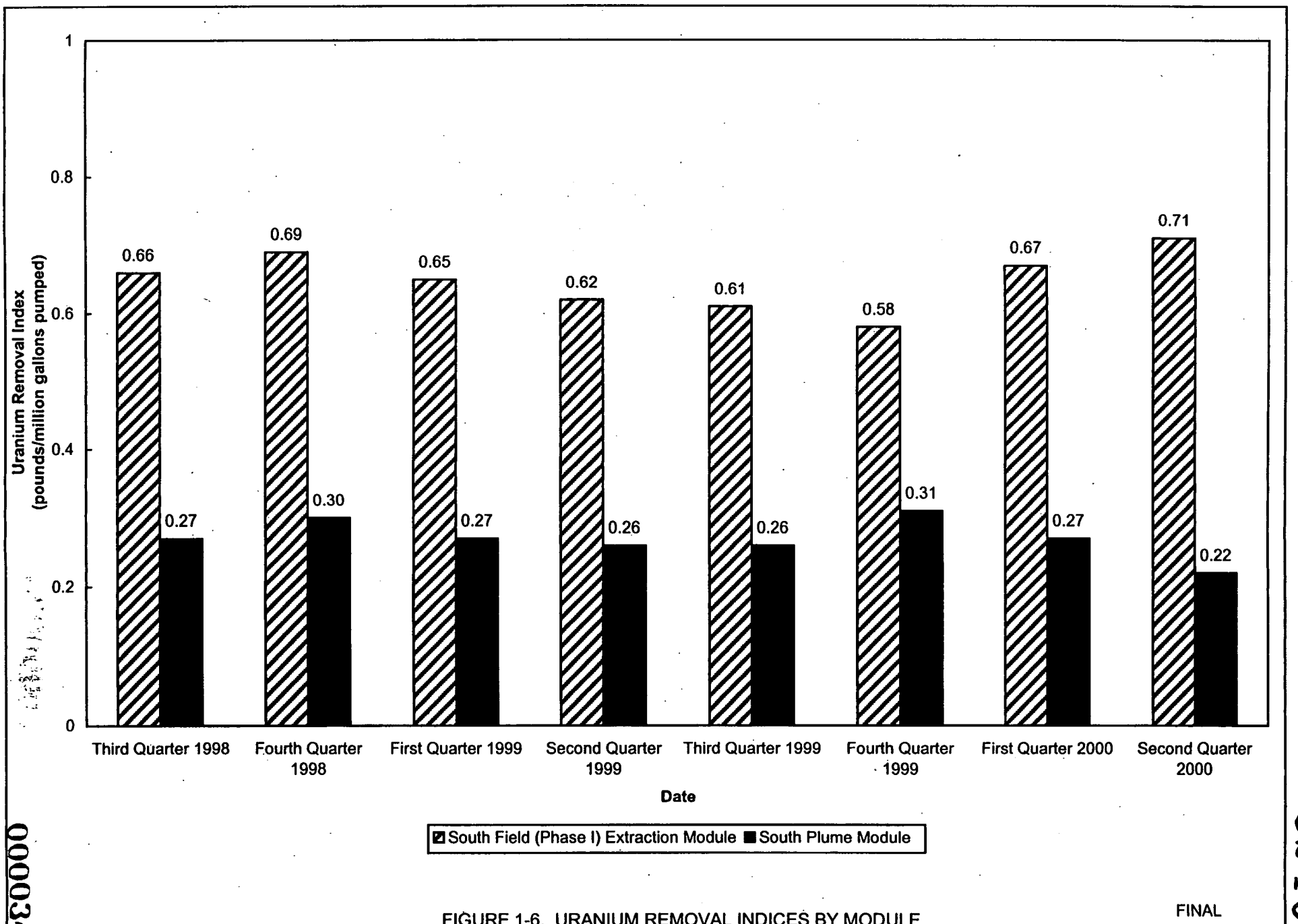


FIGURE 1-6. URANIUM REMOVAL INDICES BY MODULE

FINAL

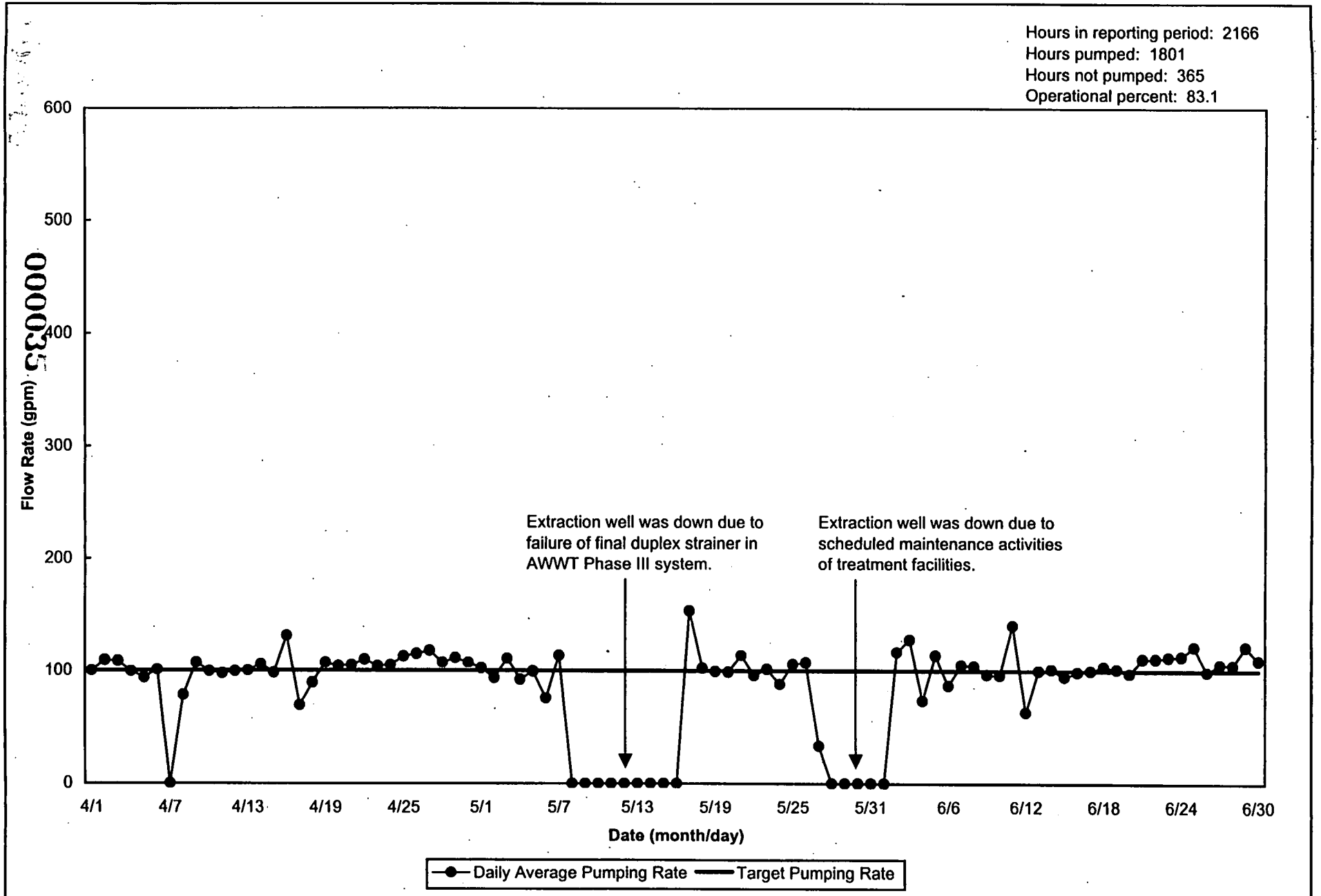


FIGURE 1-7. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31550, 4/00 - 6/00 FINAL

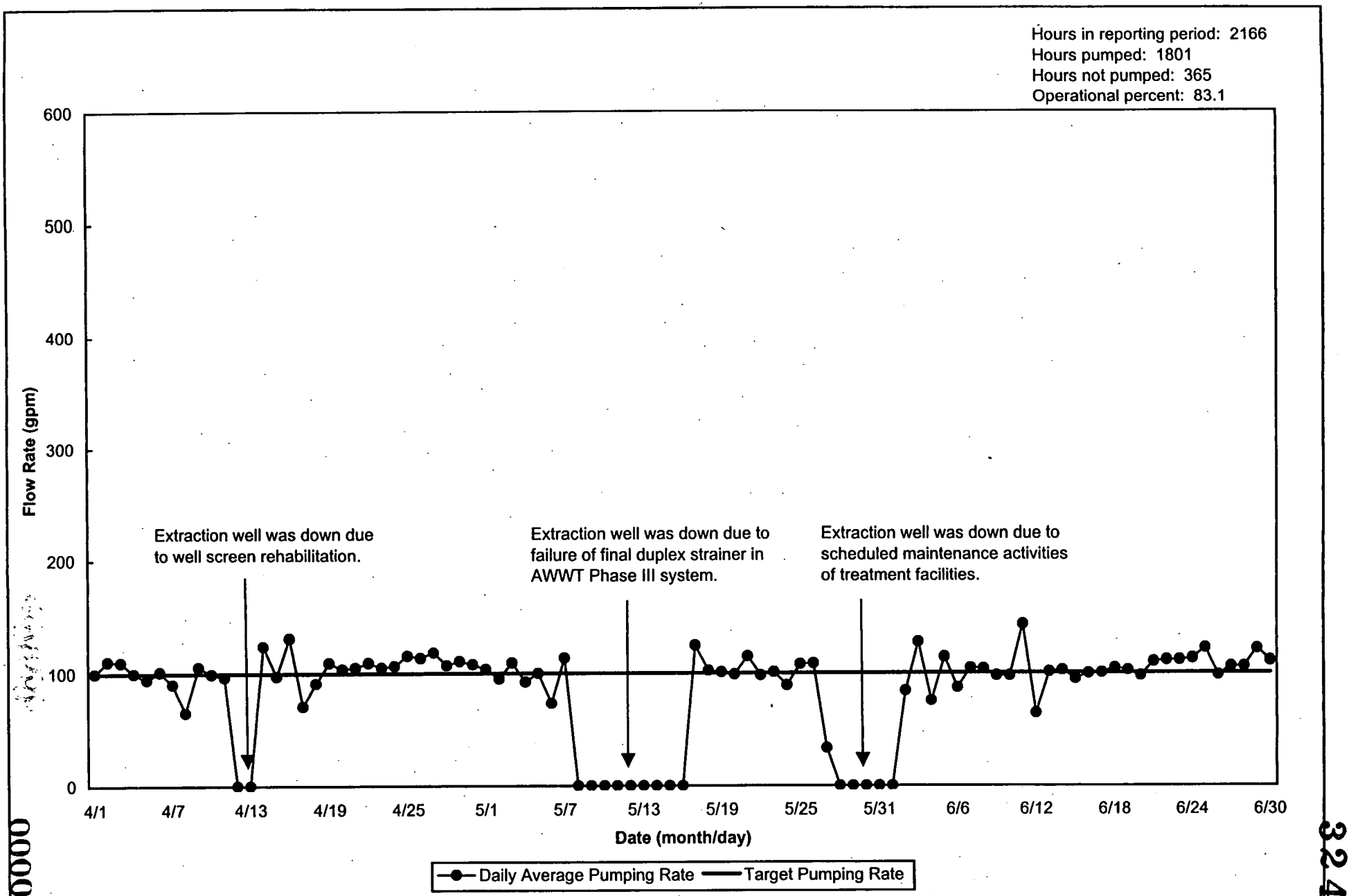


FIGURE 1-8. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31560, 4/00 - 6/00

FINAL

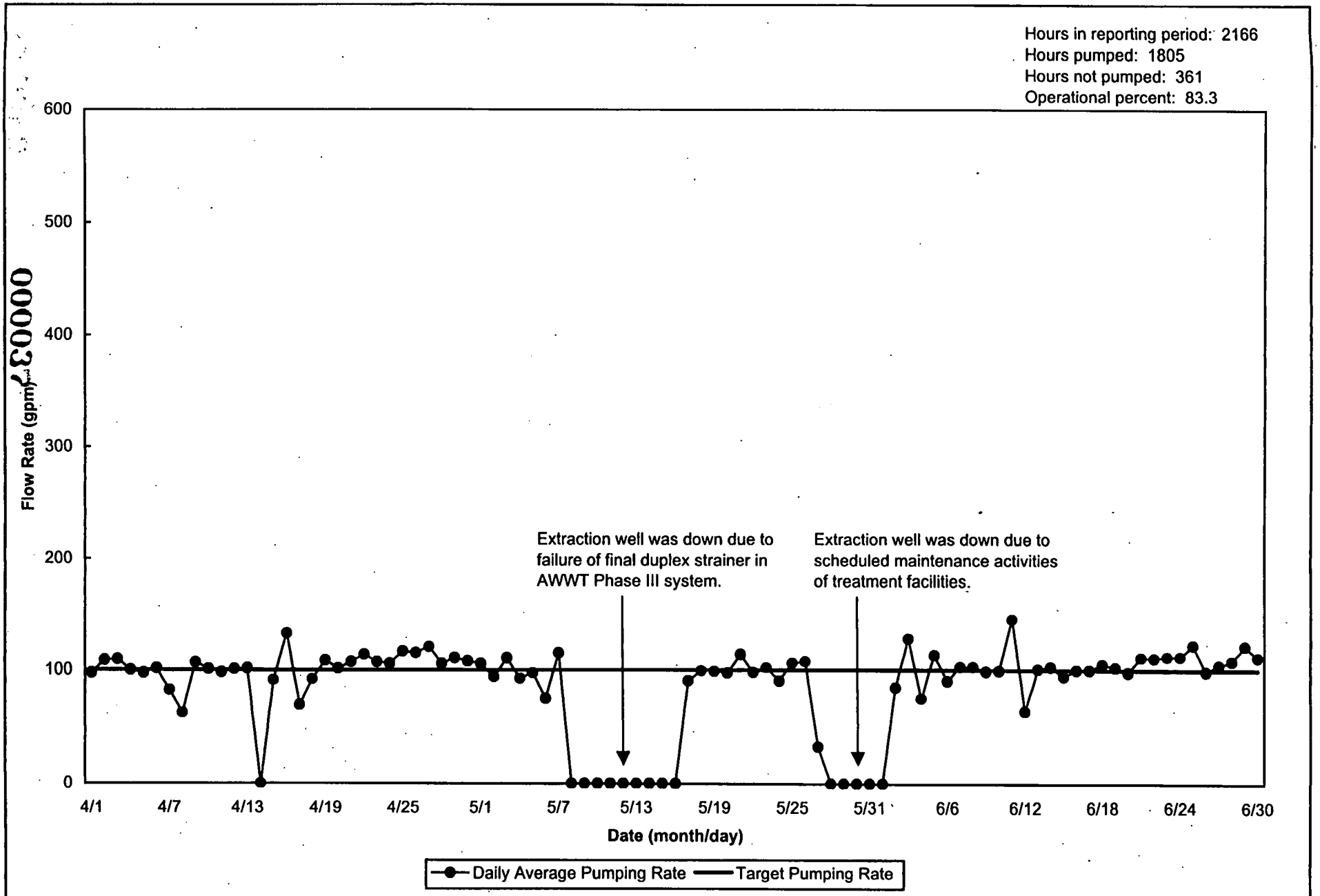


FIGURE 1-9. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31561, 4/00 - 6/00 FINAL

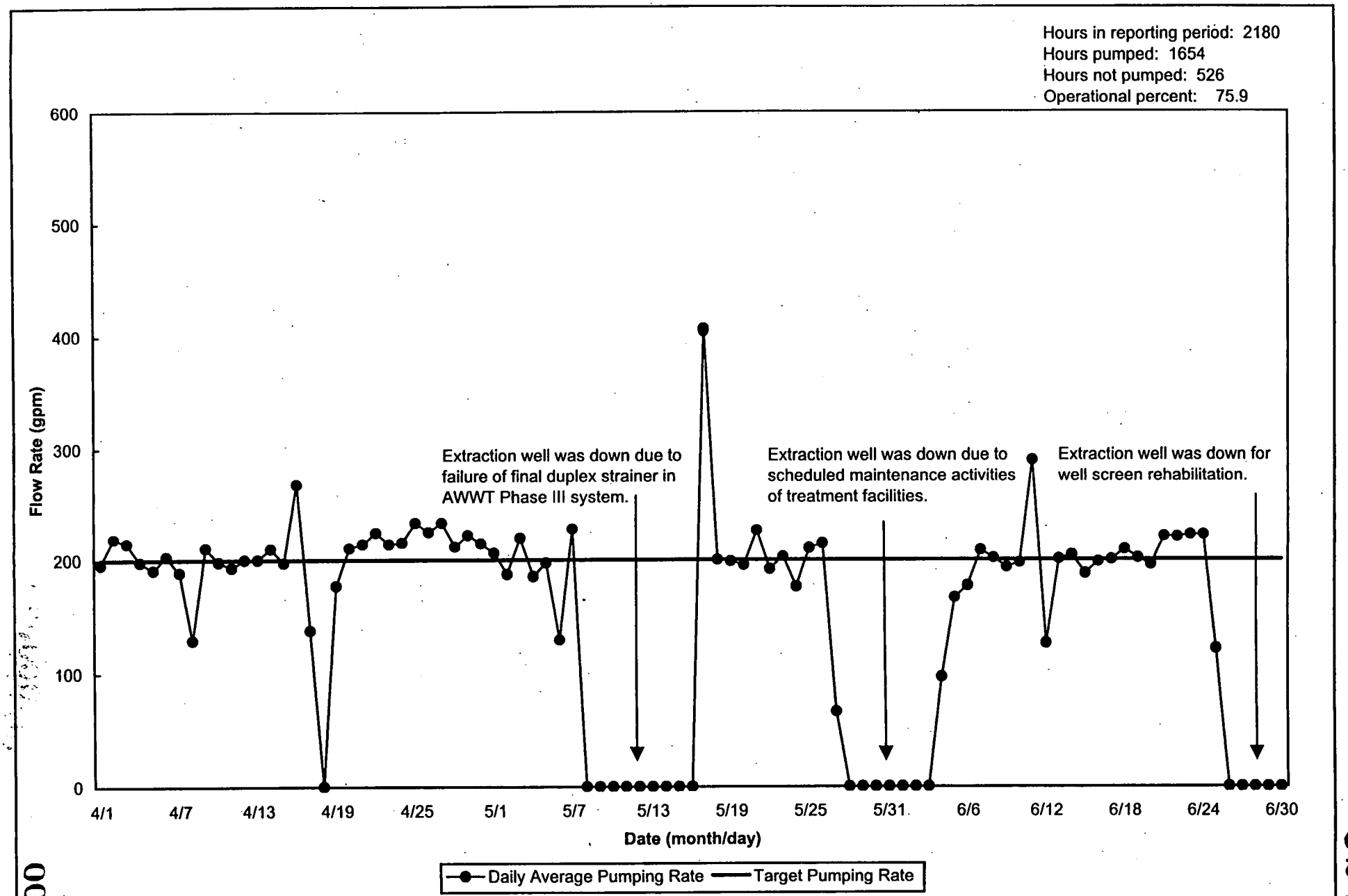


FIGURE 1-10. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31562, 4/00 - 6/00

FINAL

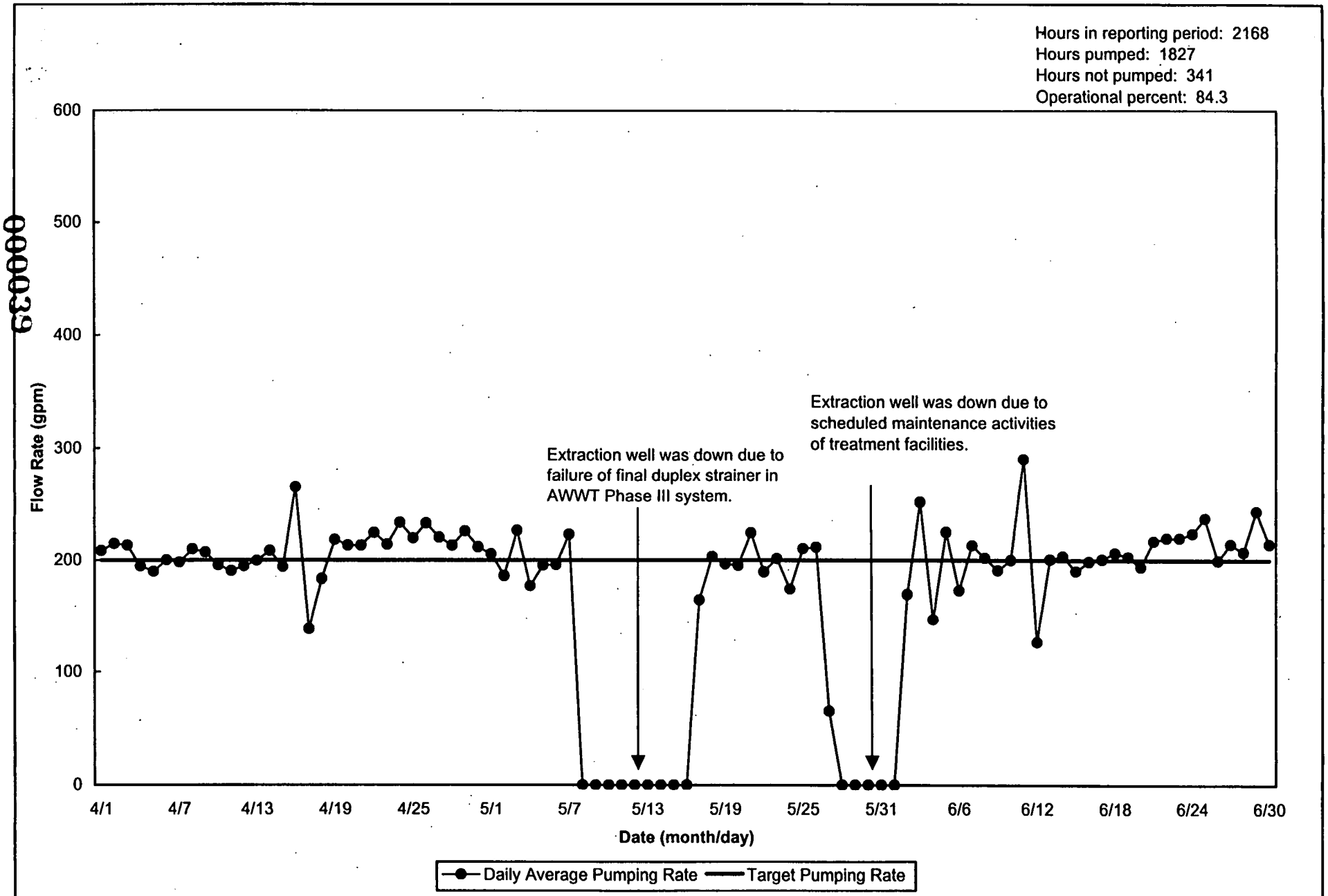


FIGURE 1-11. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31563, 4/00 - 6/00 FINAL

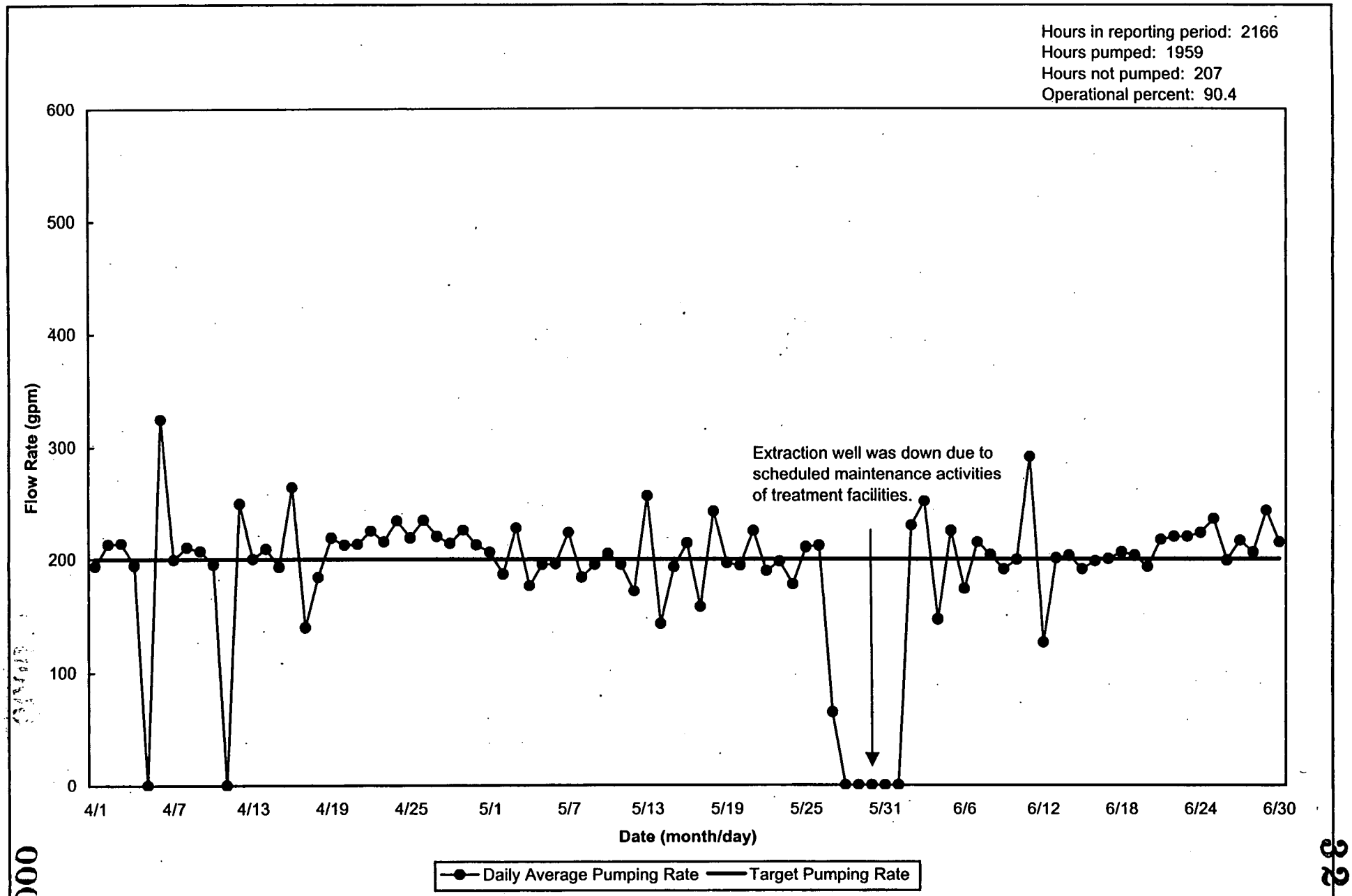


FIGURE 1-12. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31564, 4/00 - 6/00

FINAL

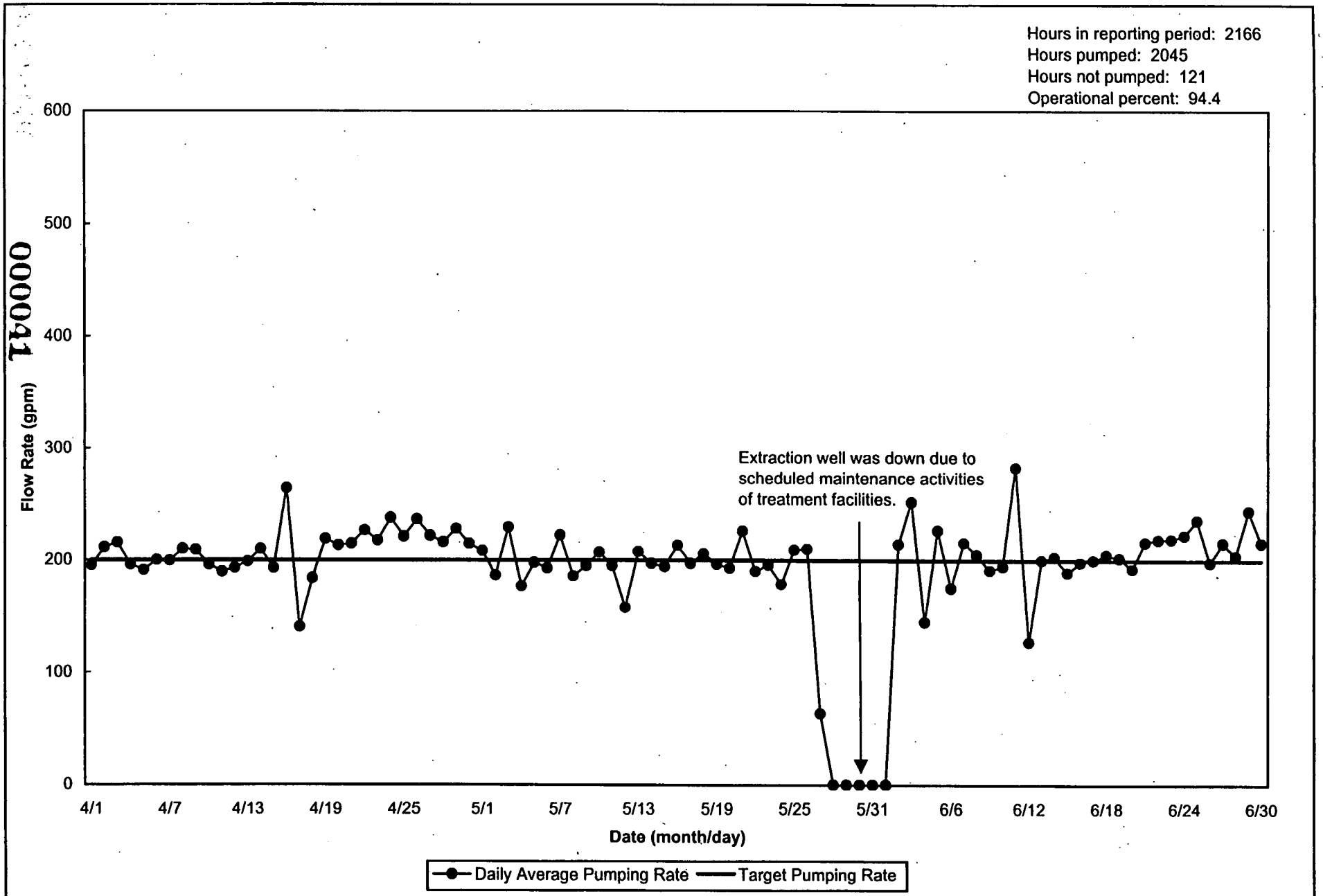


FIGURE 1-13. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31565, 4/00 - 6/00 FINAL

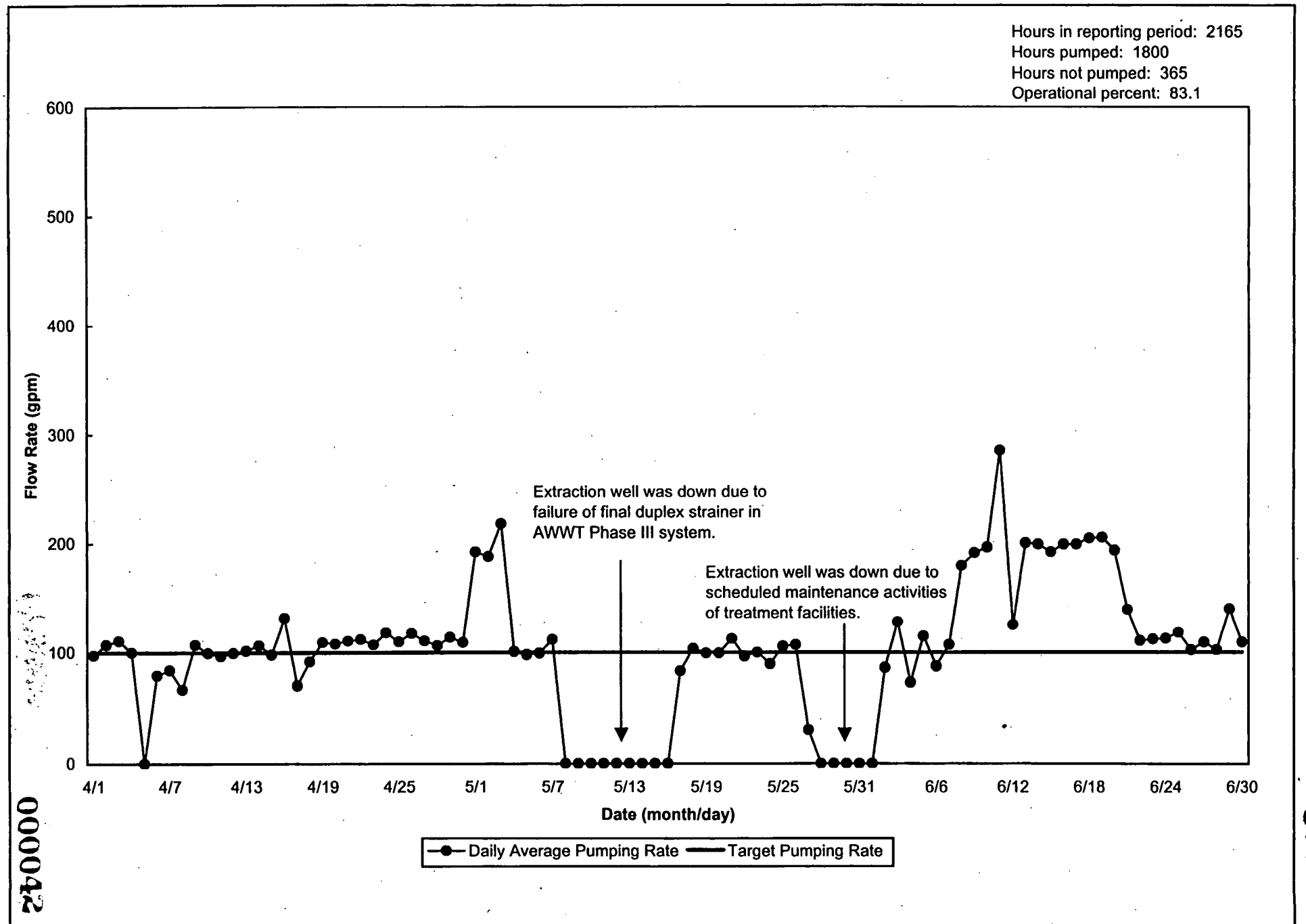


FIGURE 1-14. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 31567, 4/00 - 6/00

FINAL

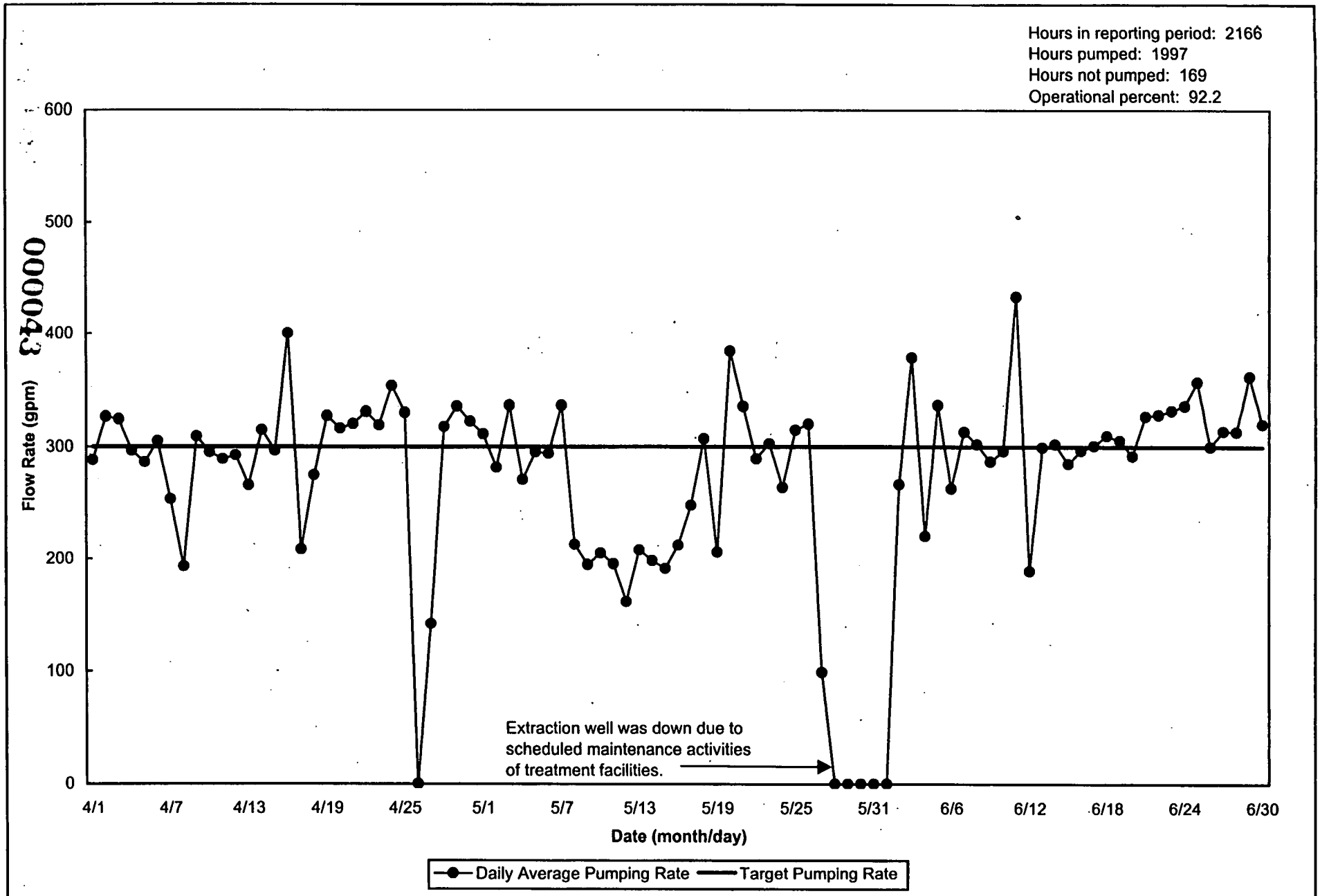


FIGURE 1-15. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 32276, 4/00 - 6/00 FINAL

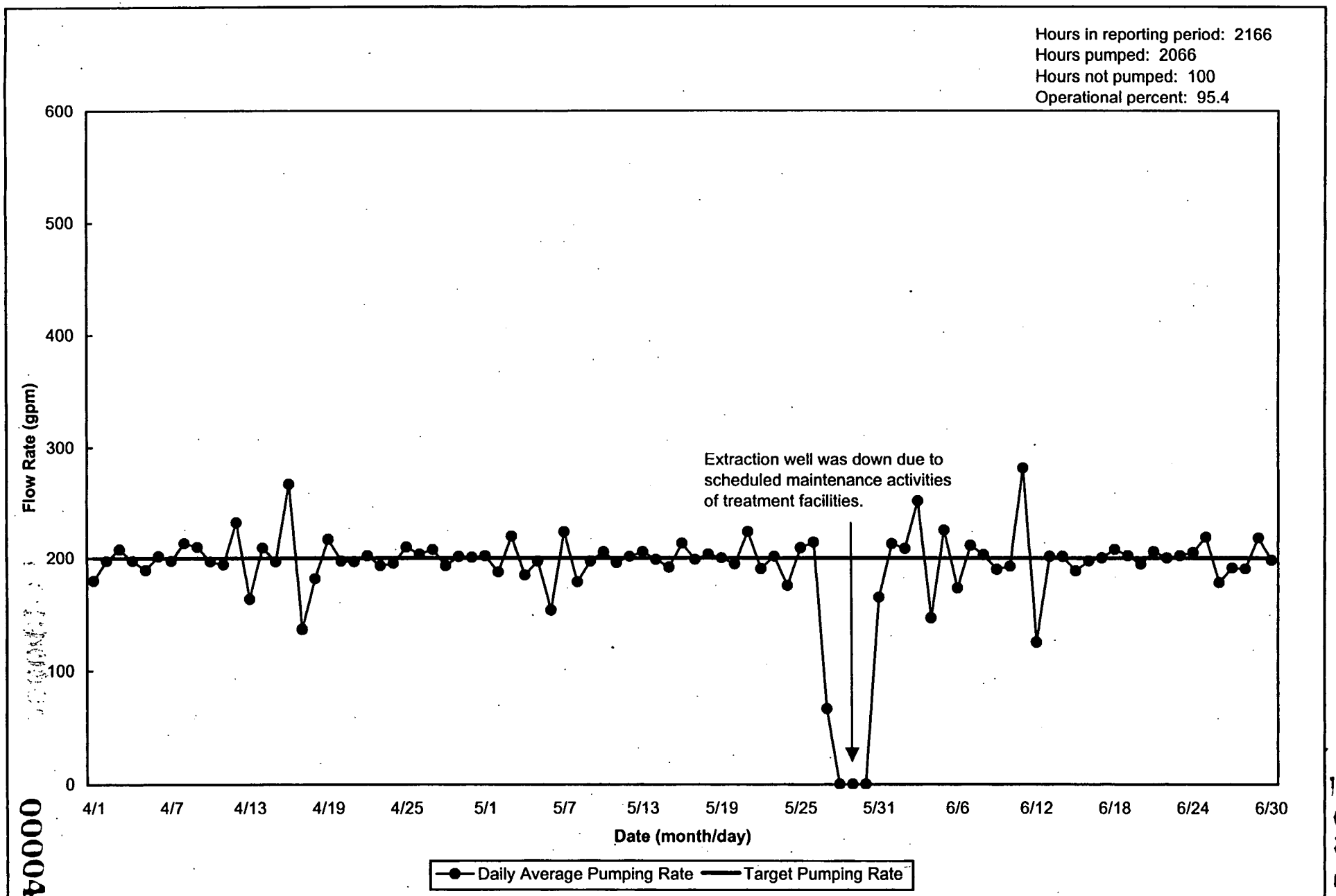


FIGURE 1-16. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 32447, 4/00 - 6/00

FINAL

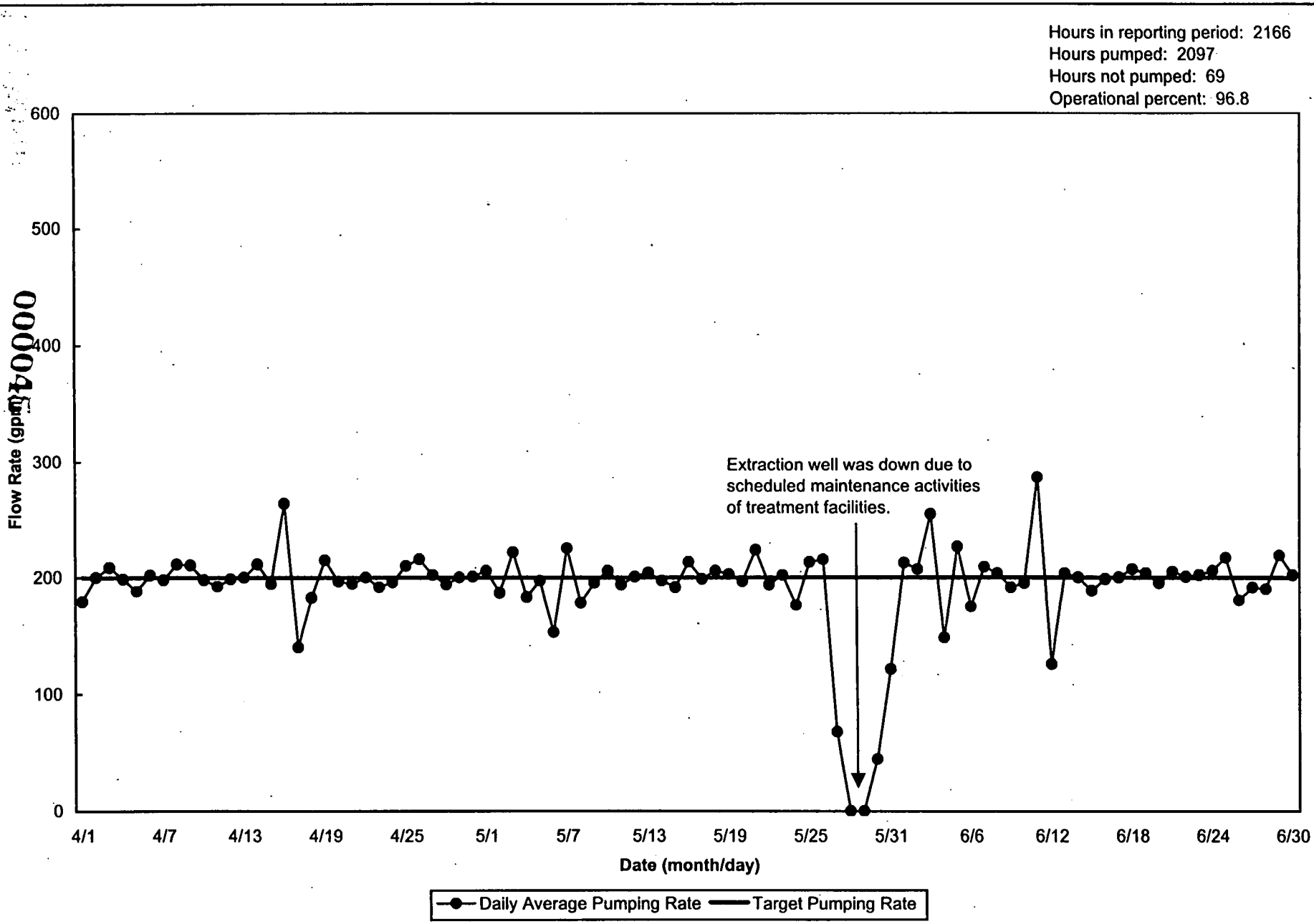
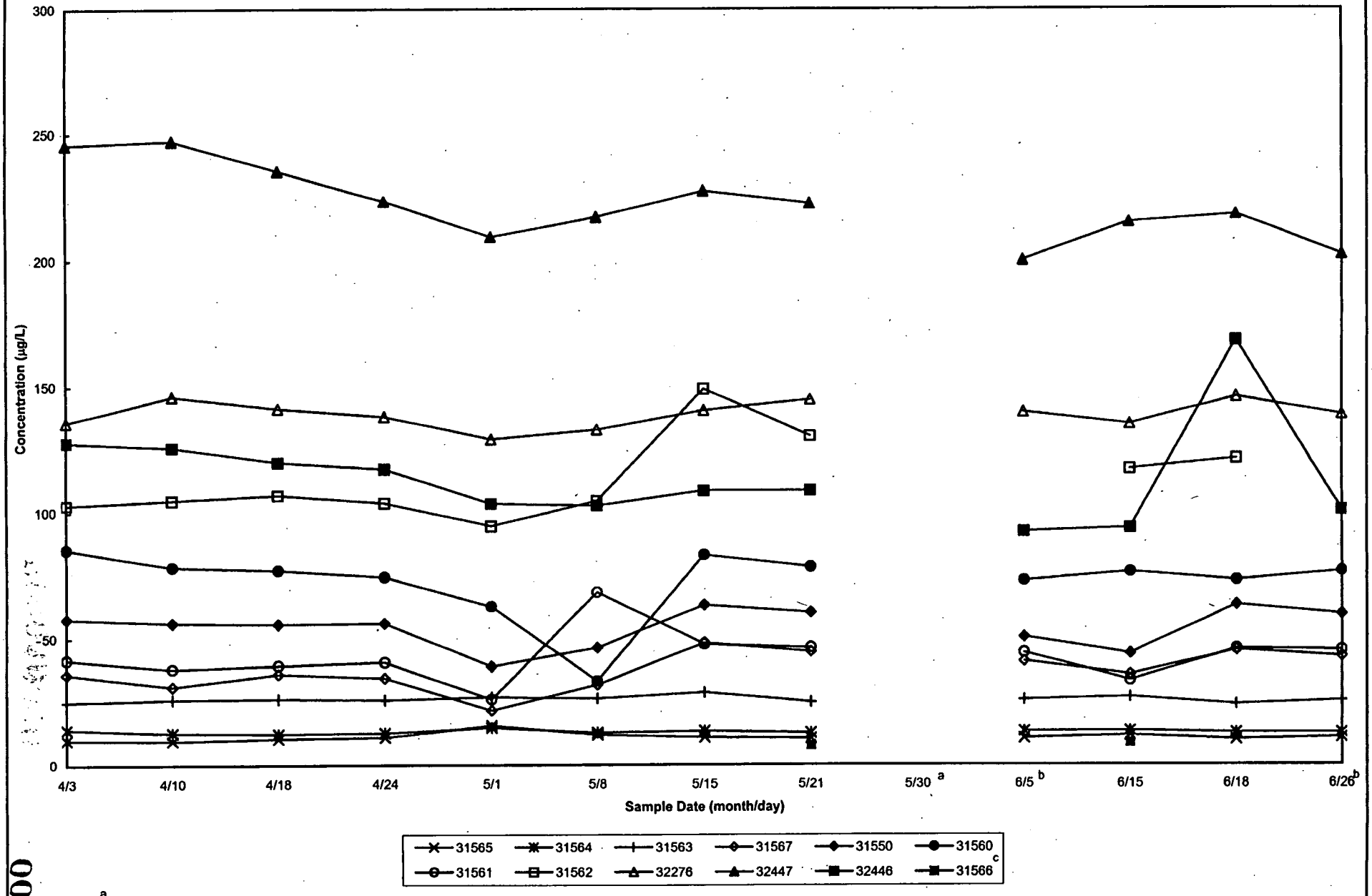


FIGURE 1-17. PUMPING RATES FOR SOUTH FIELD (PHASE I) EXTRACTION WELL 32446, 4/00 - 6/00

FINAL



[a] None of the extraction wells were sampled on May 30, 2000.

[b] A sample was not collected for Extraction Well 31562.

[c] Monthly sampling for total uranium resumed in May.

FIGURE 1-18. WEEKLY TOTAL URANIUM CONCENTRATIONS FOR THE SOUTH FIELD (PHASE I) EXTRACTION MODULE FINAL

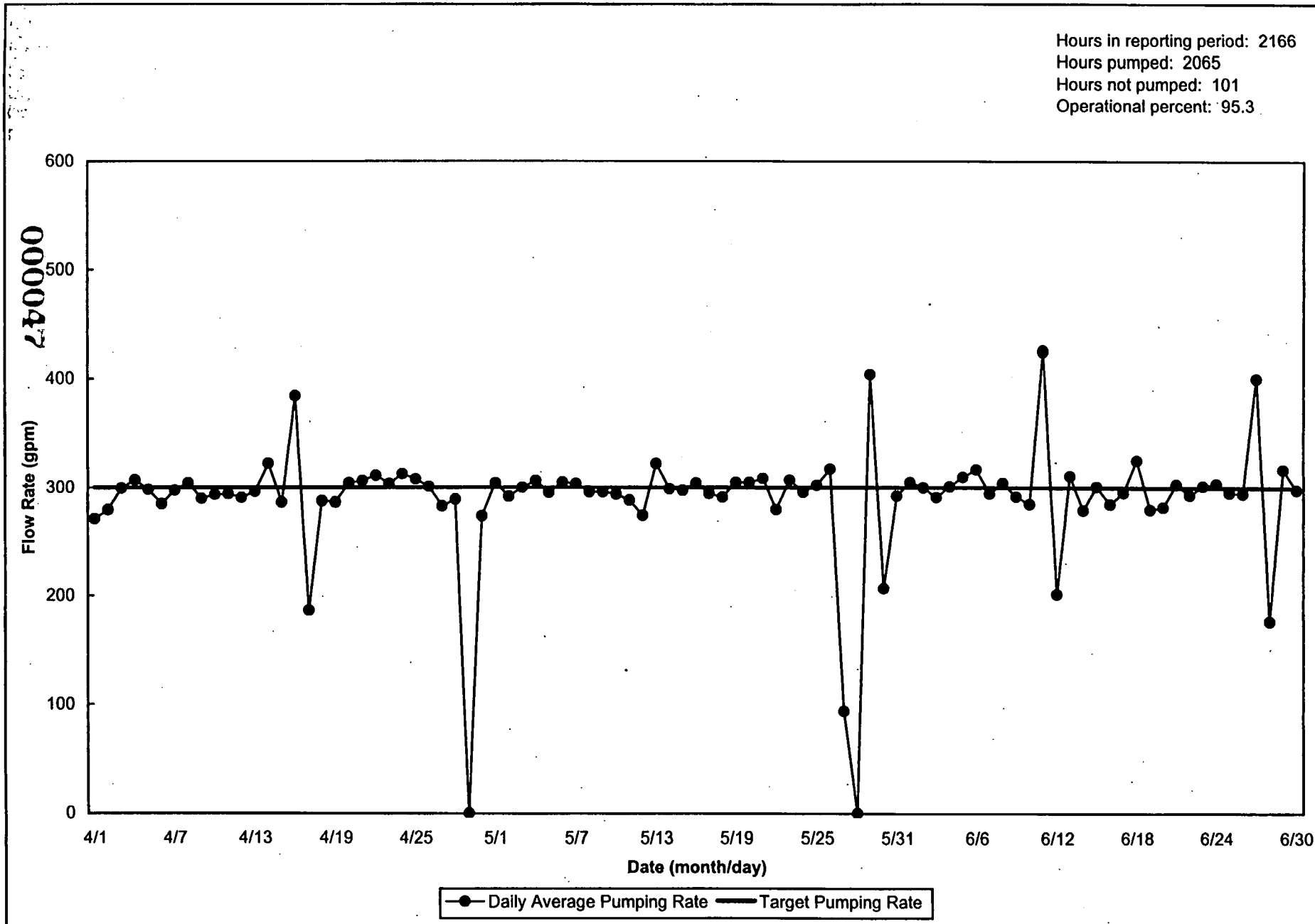


FIGURE 1-19. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 3924, 4/00 - 6/00

FINAL

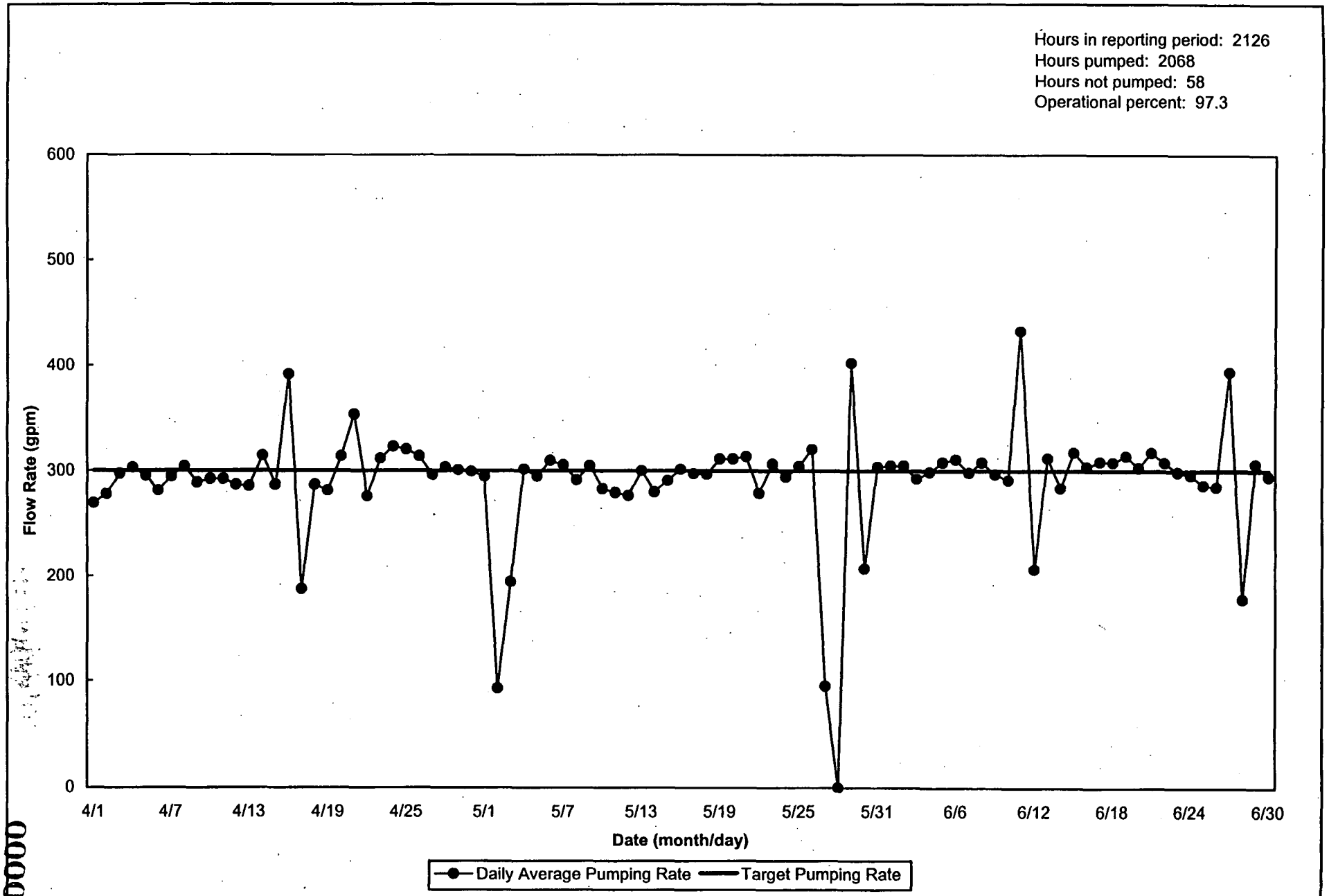


FIGURE 1-20. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 3925, 4/00 - 6/00

FINAL

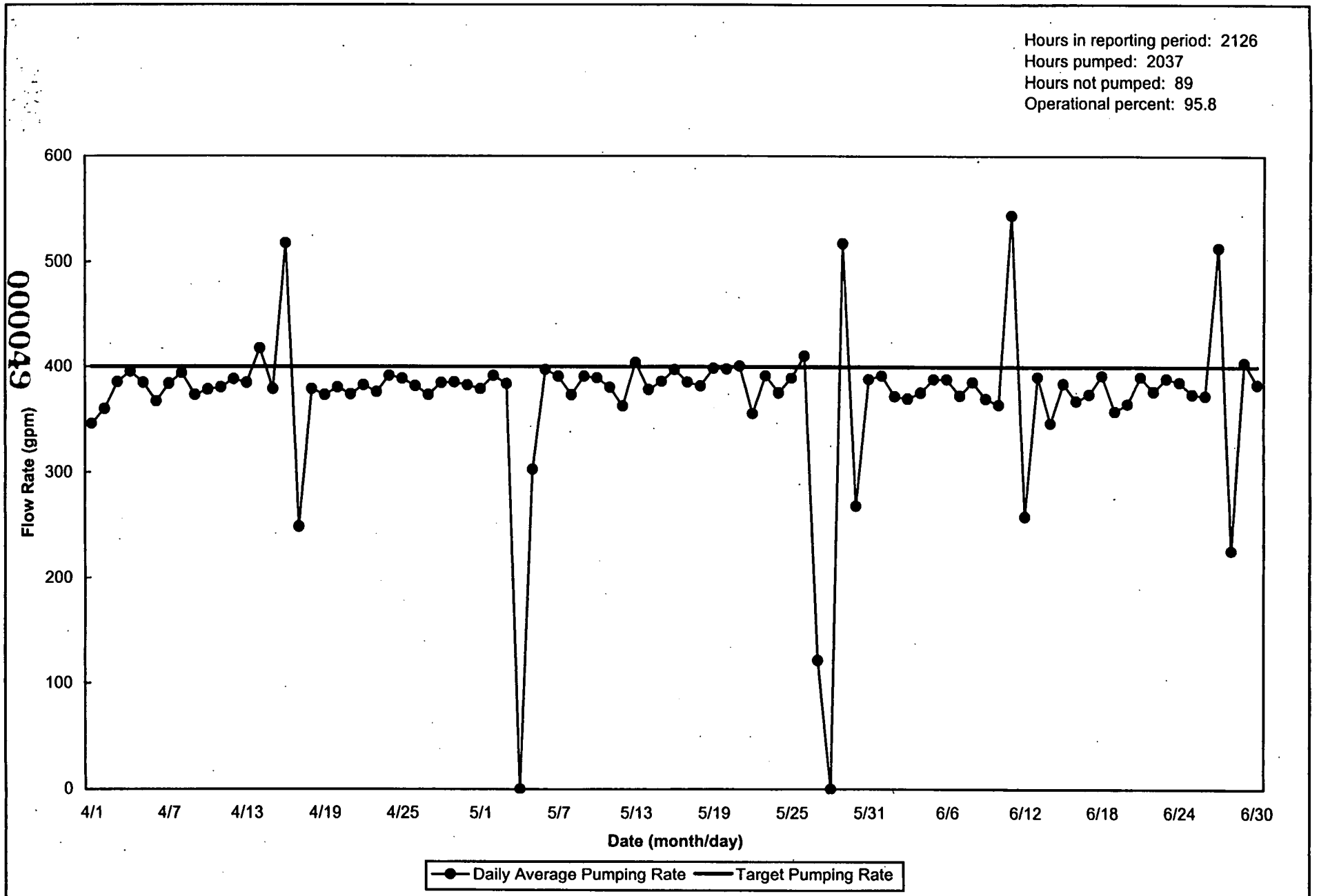


FIGURE 1-21. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 3926, 4/00 - 6/00

FINAL

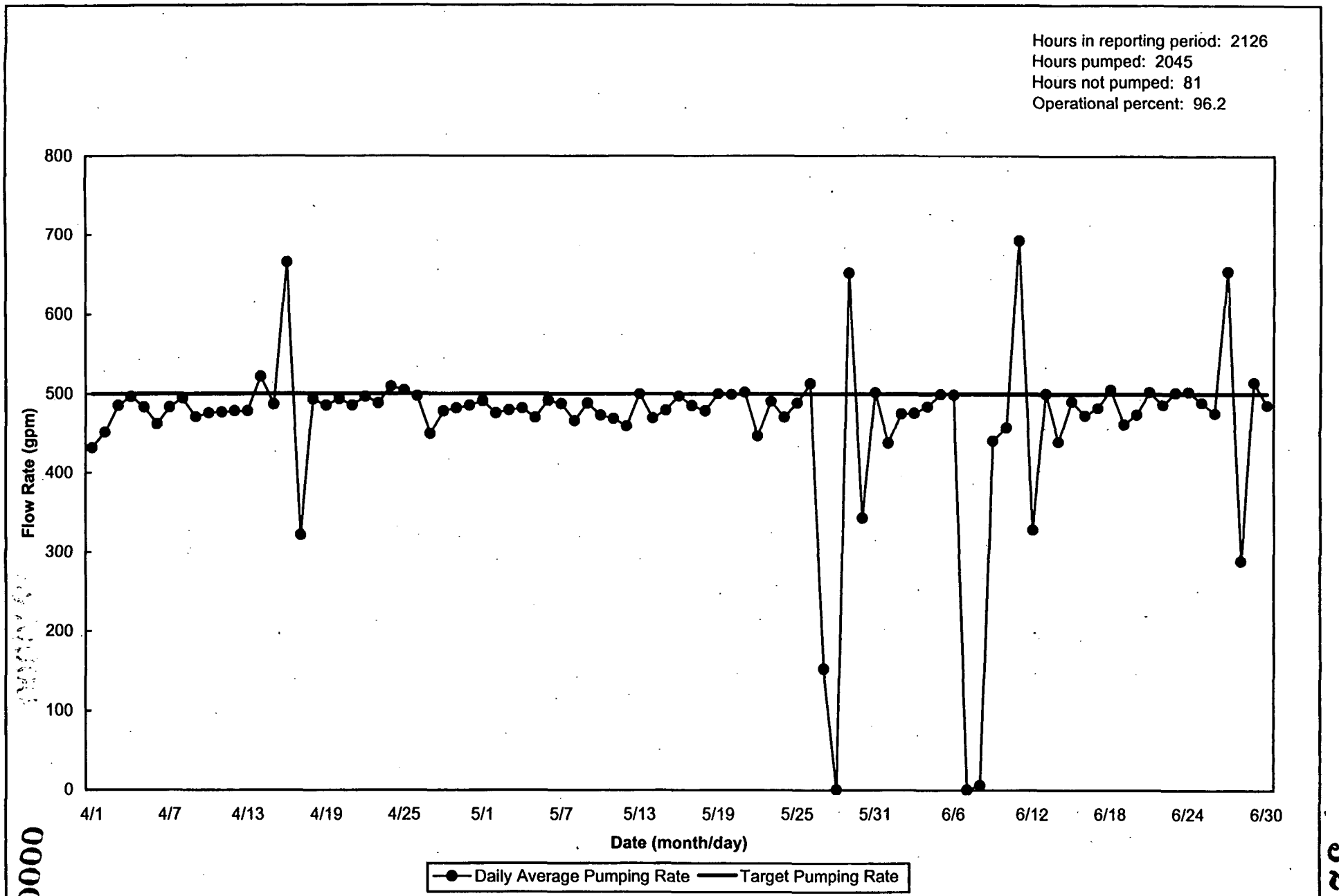


FIGURE 1-22. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 3927, 4/00 - 6/00

FINAL

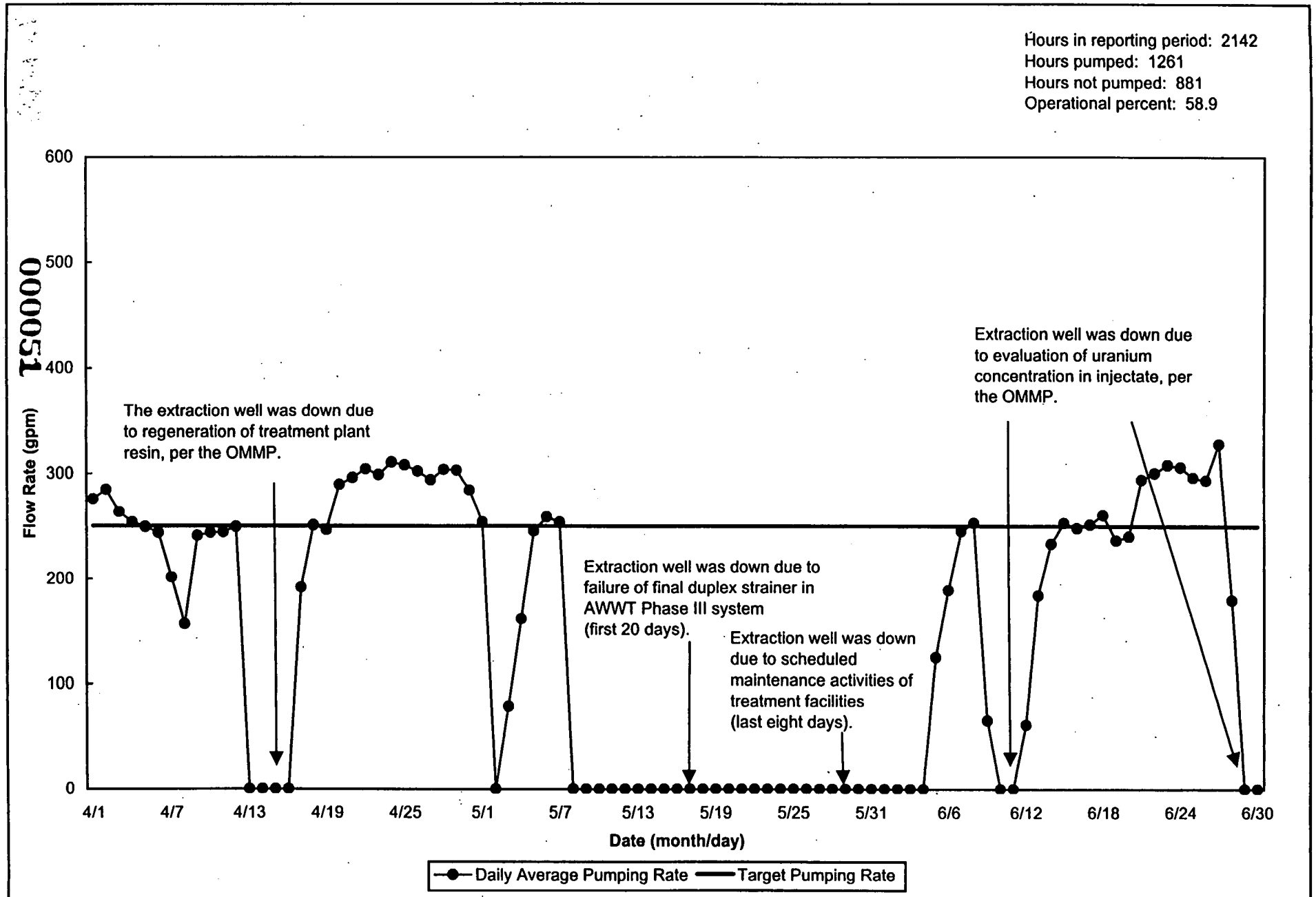


FIGURE 1-23. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 32308, 4/00 - 6/00

FINAL

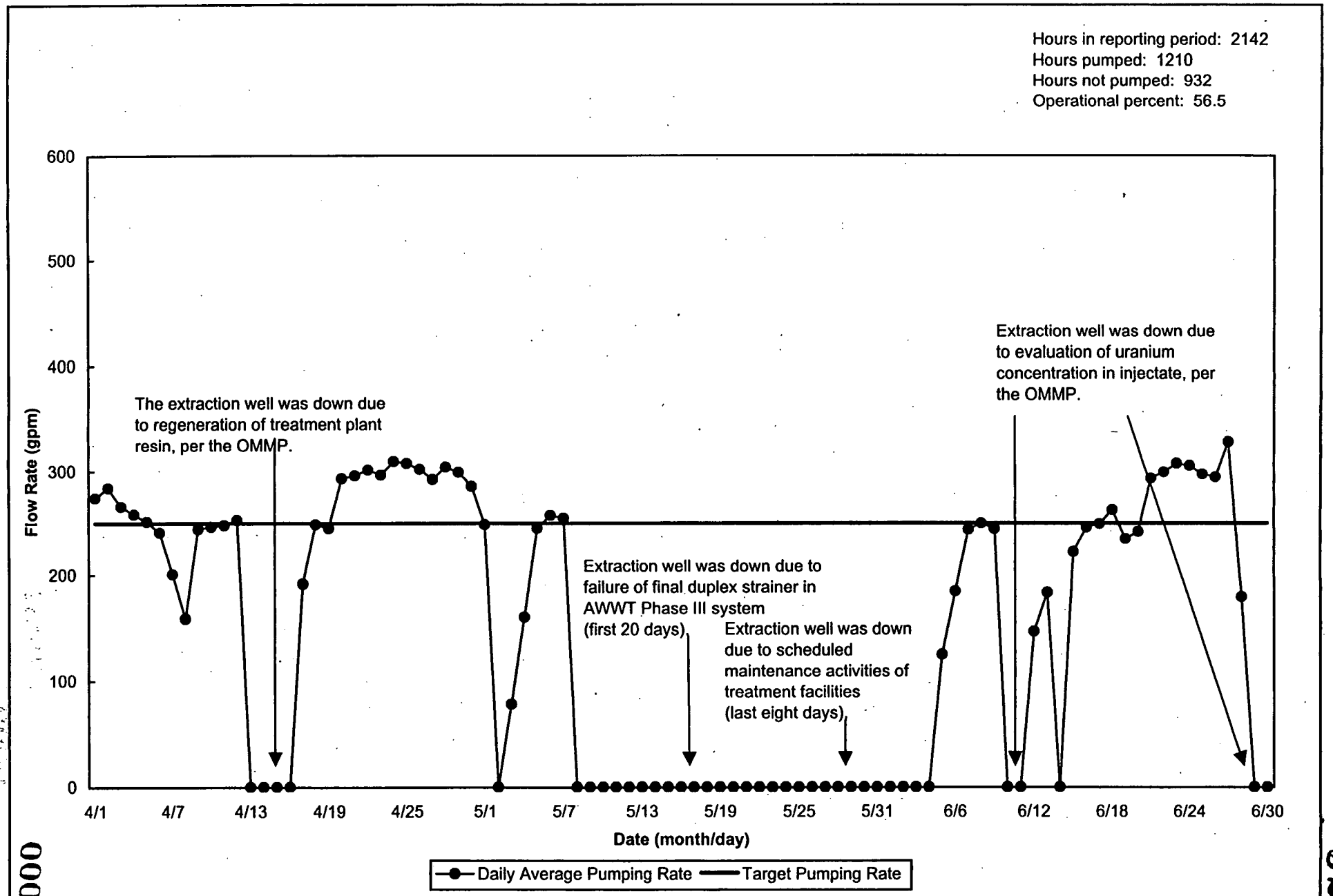
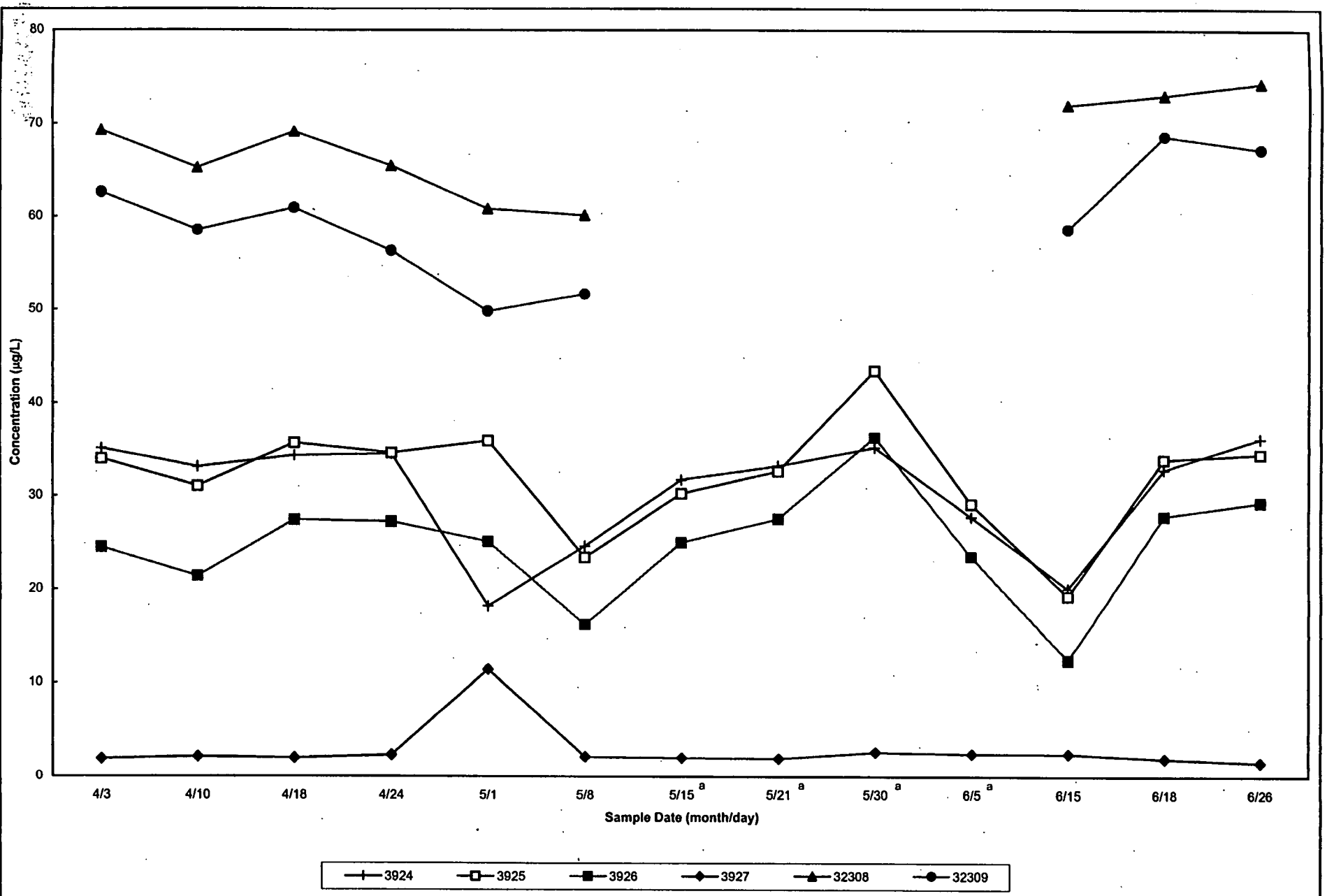


FIGURE 1-24. PUMPING RATES FOR SOUTH PLUME EXTRACTION WELL 32309, 4/00 - 6/00

FINAL

250000

32346



[a] Samples were not collected for Extraction Wells 32308 and 32309.

FIGURE 1-25. WEEKLY TOTAL URANIUM CONCENTRATIONS FOR THE SOUTH PLUME MODULE

FINAL

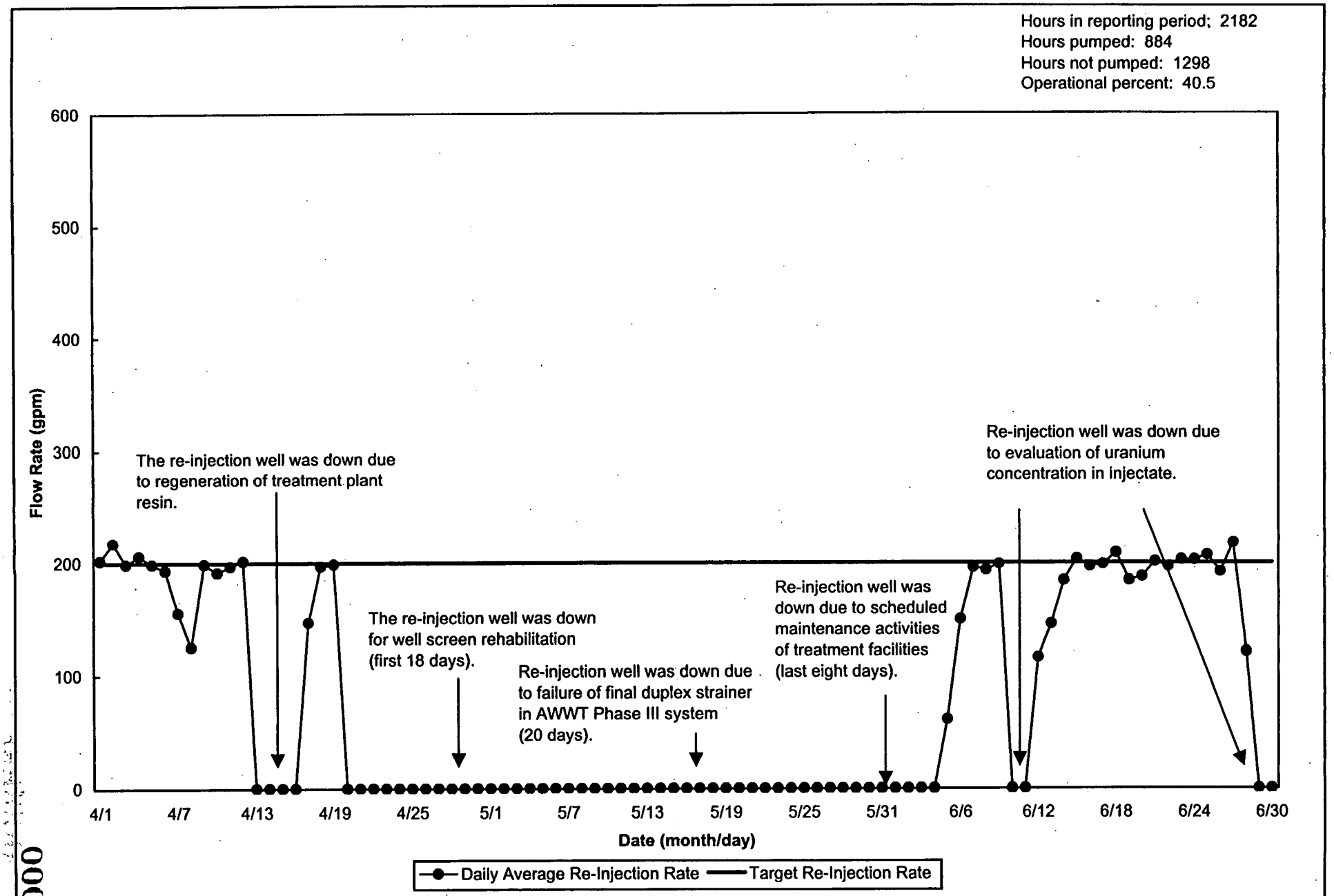


FIGURE 1-26. RE-INJECTION RATES FOR WELL 22107, 4/00 - 6/00

FINAL

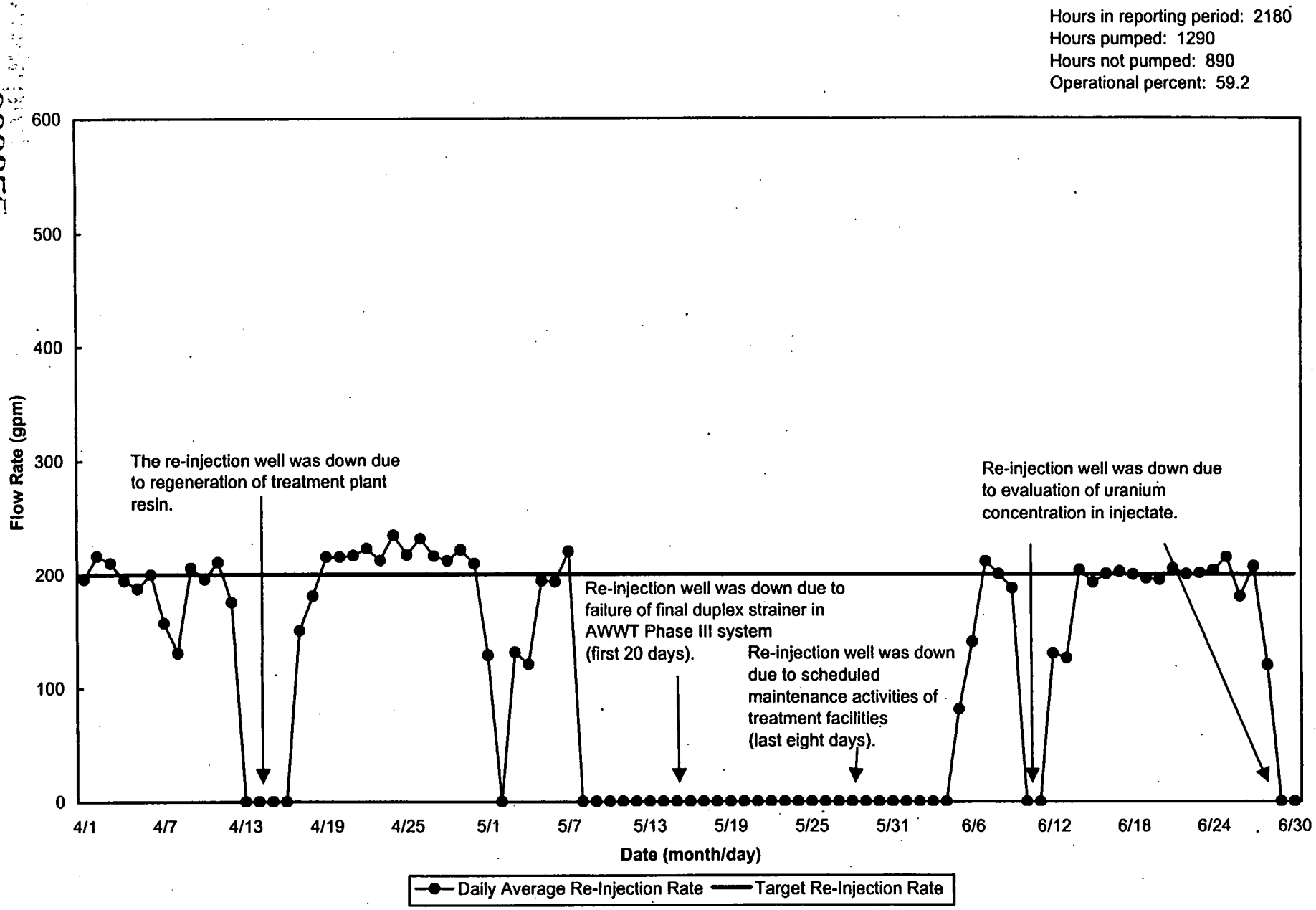


FIGURE 1-27. RE-INJECTION RATES FOR WELL 22108, 4/00 - 6/00

FINAL

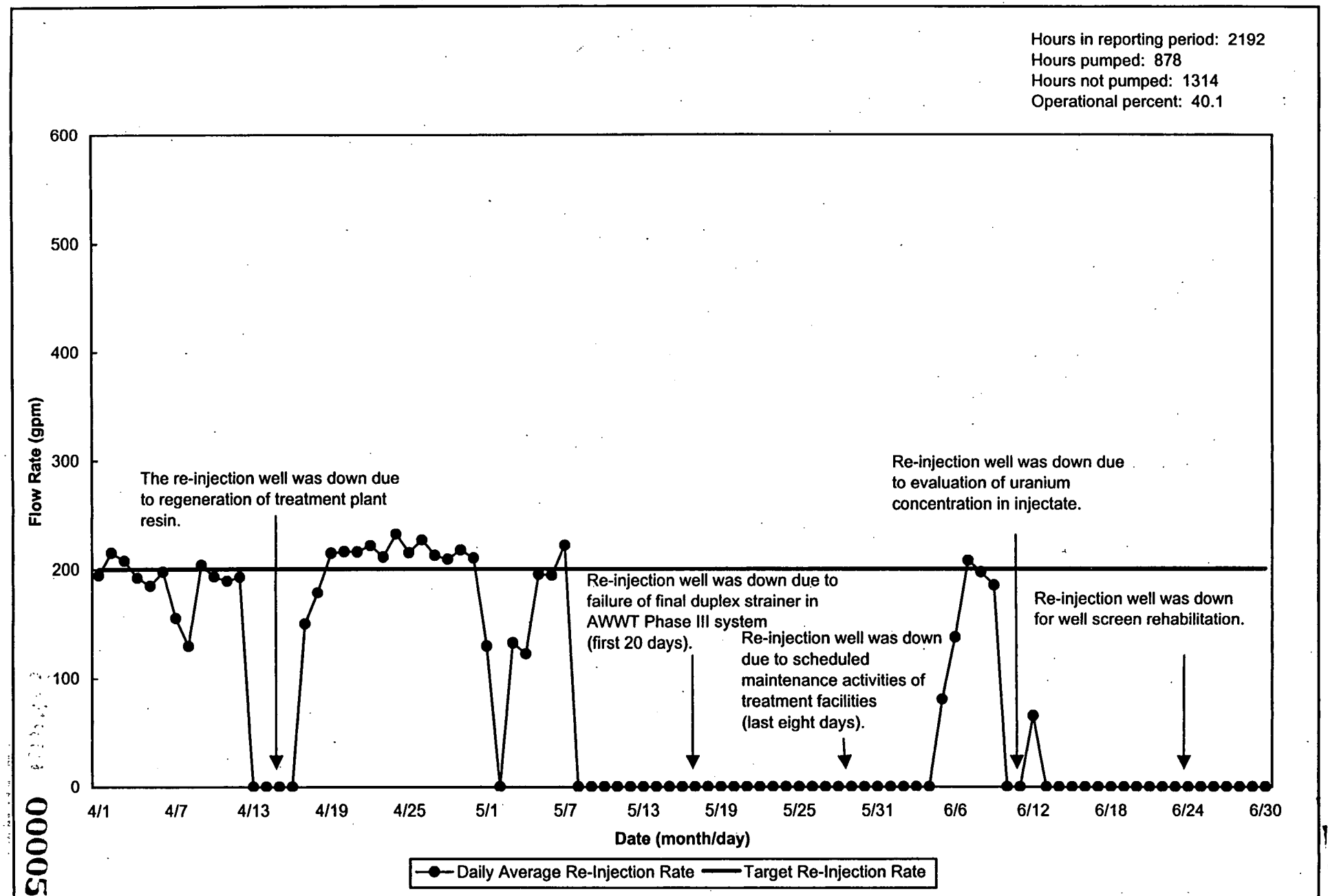


FIGURE 1-28. RE-INJECTION RATES FOR WELL 22109, 4/00 - 6/00

FINAL

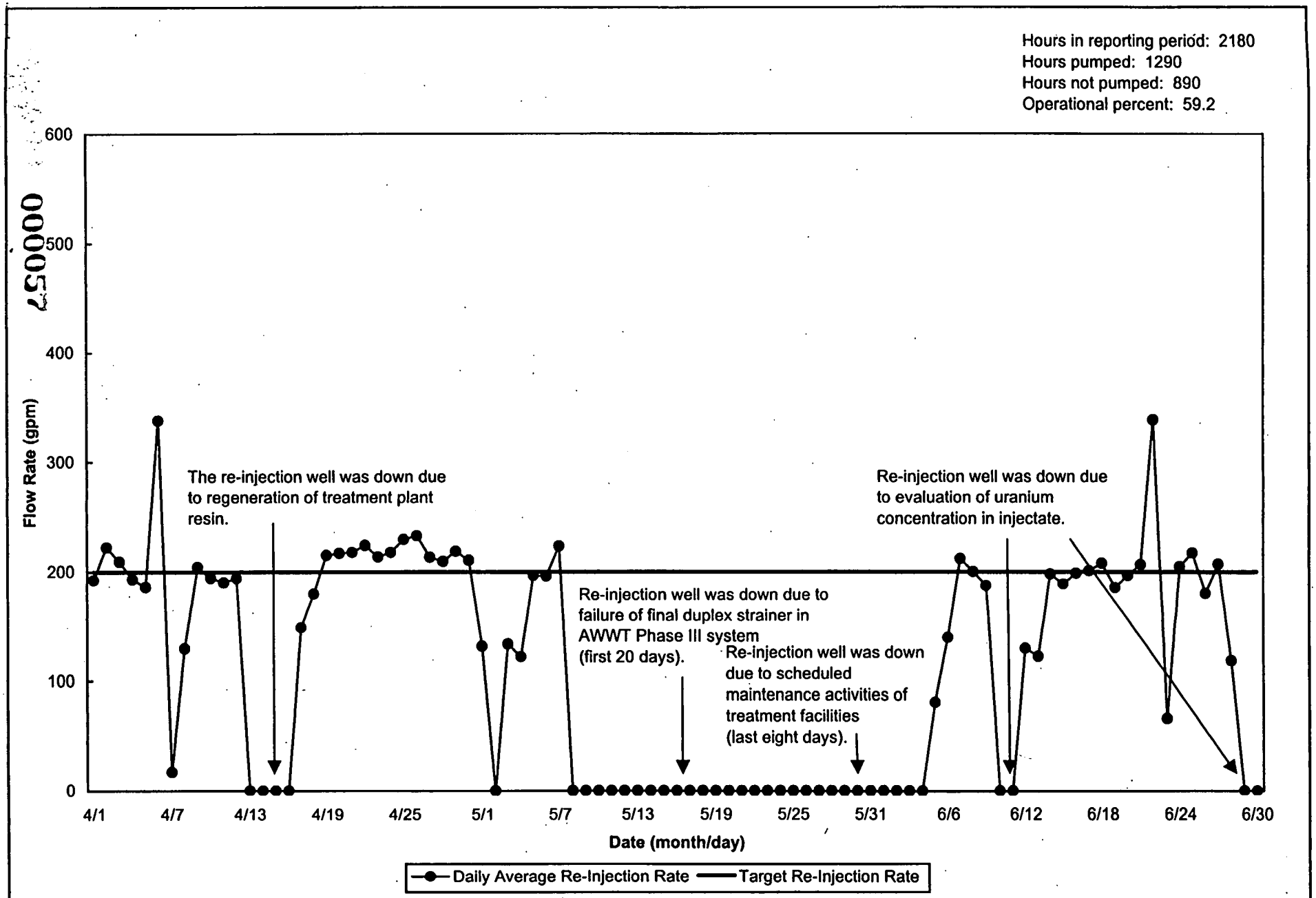


FIGURE 1-29. RE-INJECTION RATES FOR WELL 22111, 4/00 - 6/00

FINAL

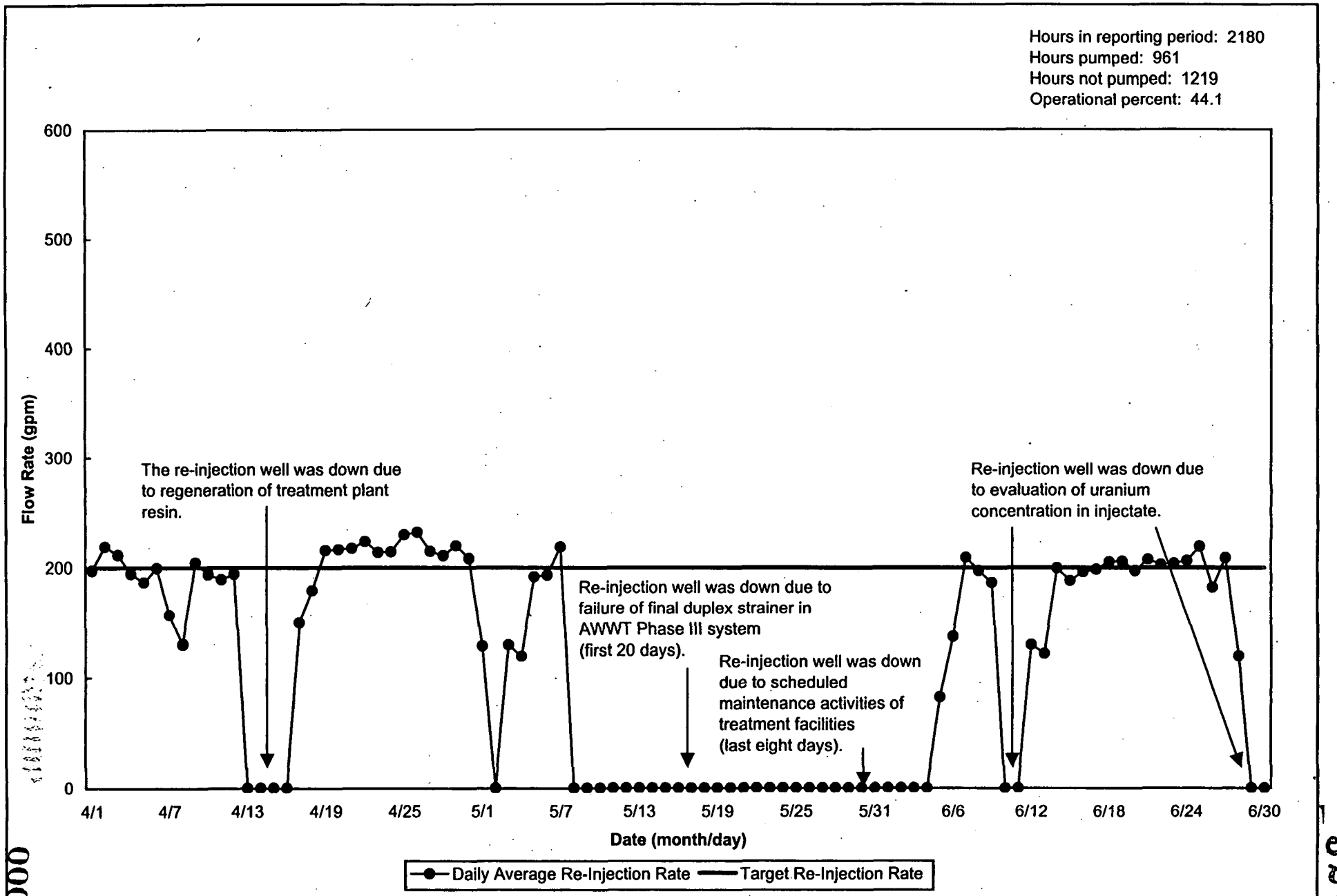
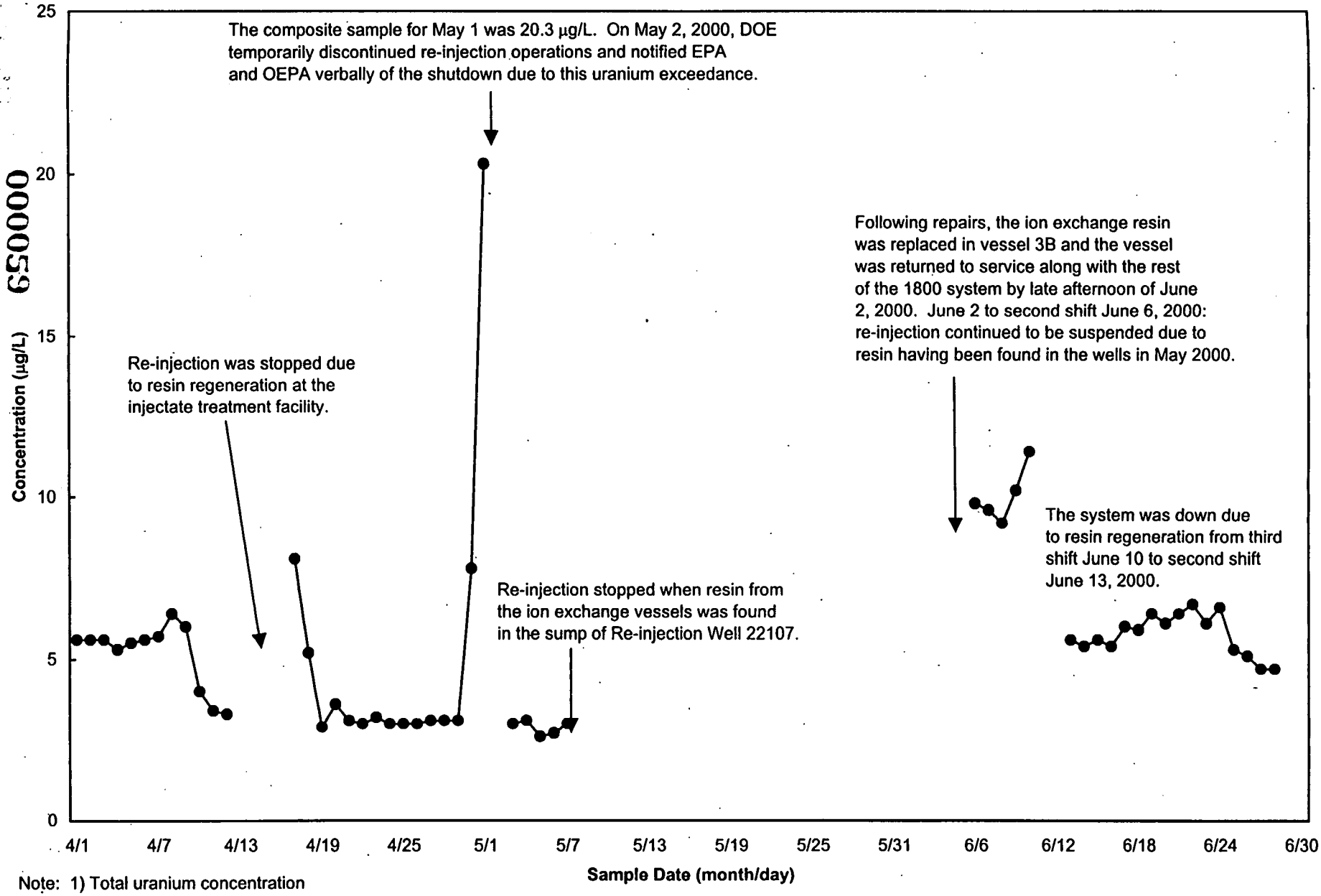


FIGURE 1-30. RE-INJECTION RATES FOR WELL 22240, 4/00 - 6/00

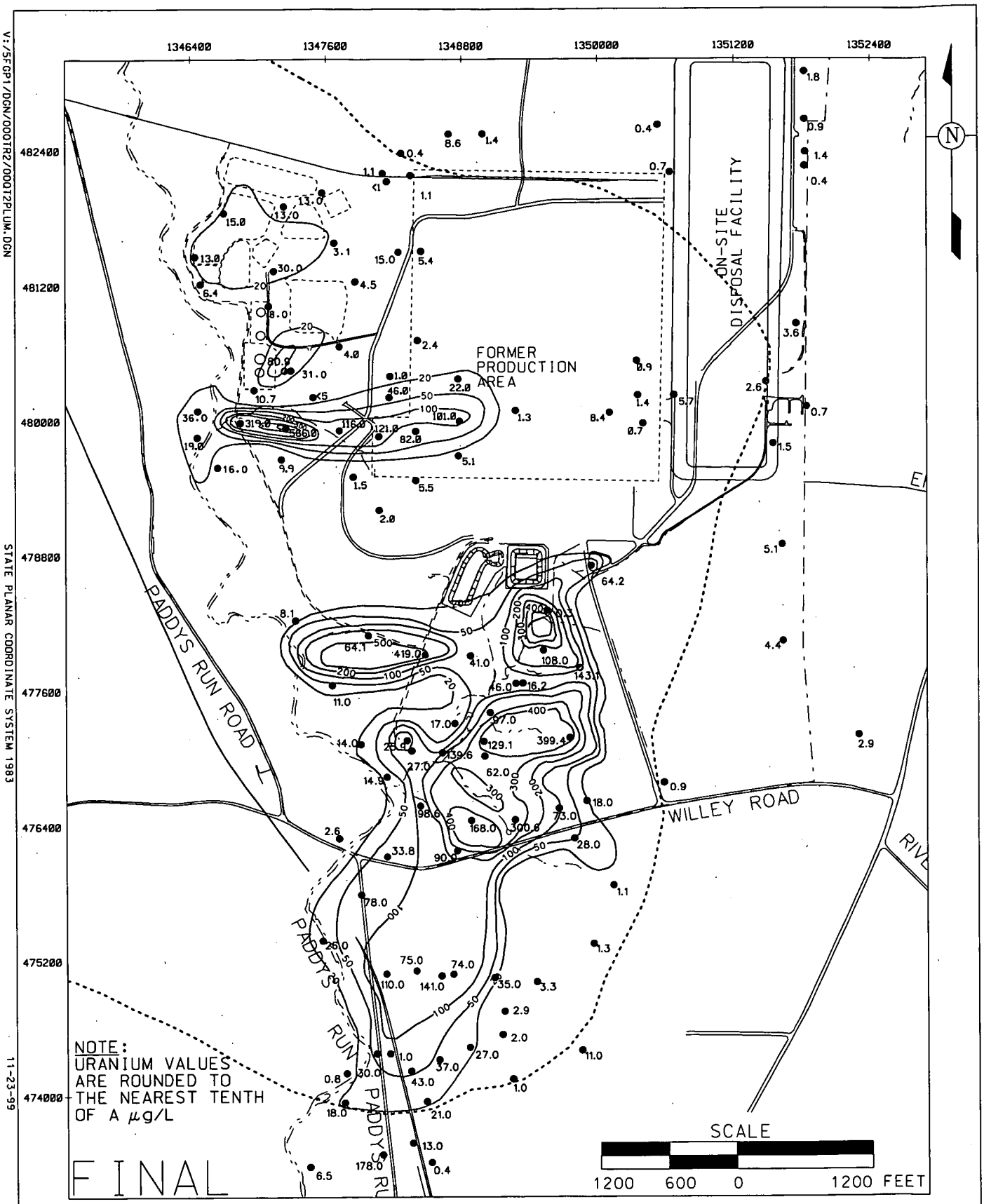
FINAL



Note: 1) Total uranium concentration required to be less than 20 µg/L.
2) Blank spaces indicate that re-injection was not occurring.

FIGURE 1-31. TOTAL URANIUM CONCENTRATIONS IN INJECTATE, 4/00 - 6/00

FINAL



000060

FIGURE 1-32. TOTAL URANIUM PLUME MAP, FIRST QUARTER 2000

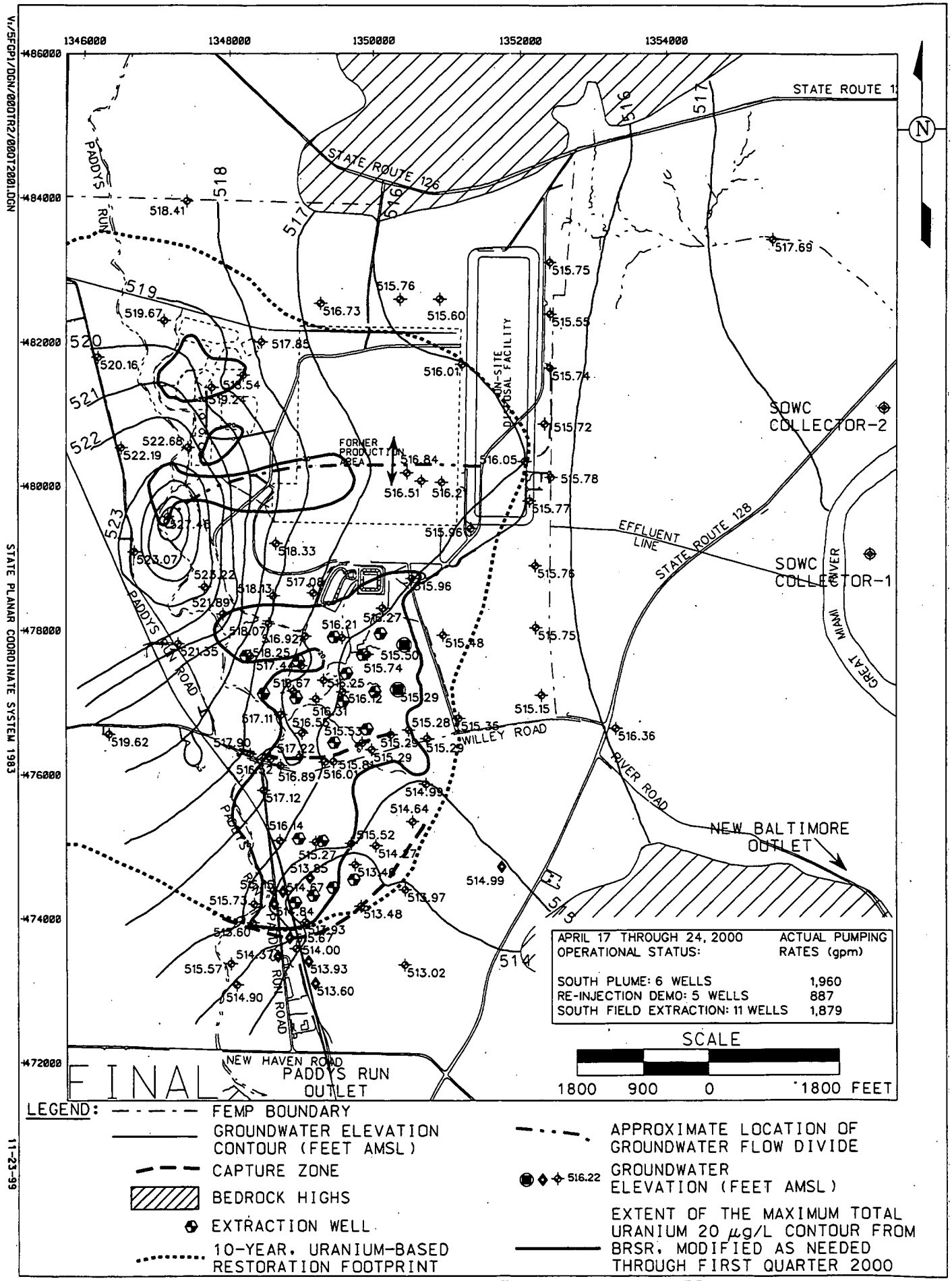
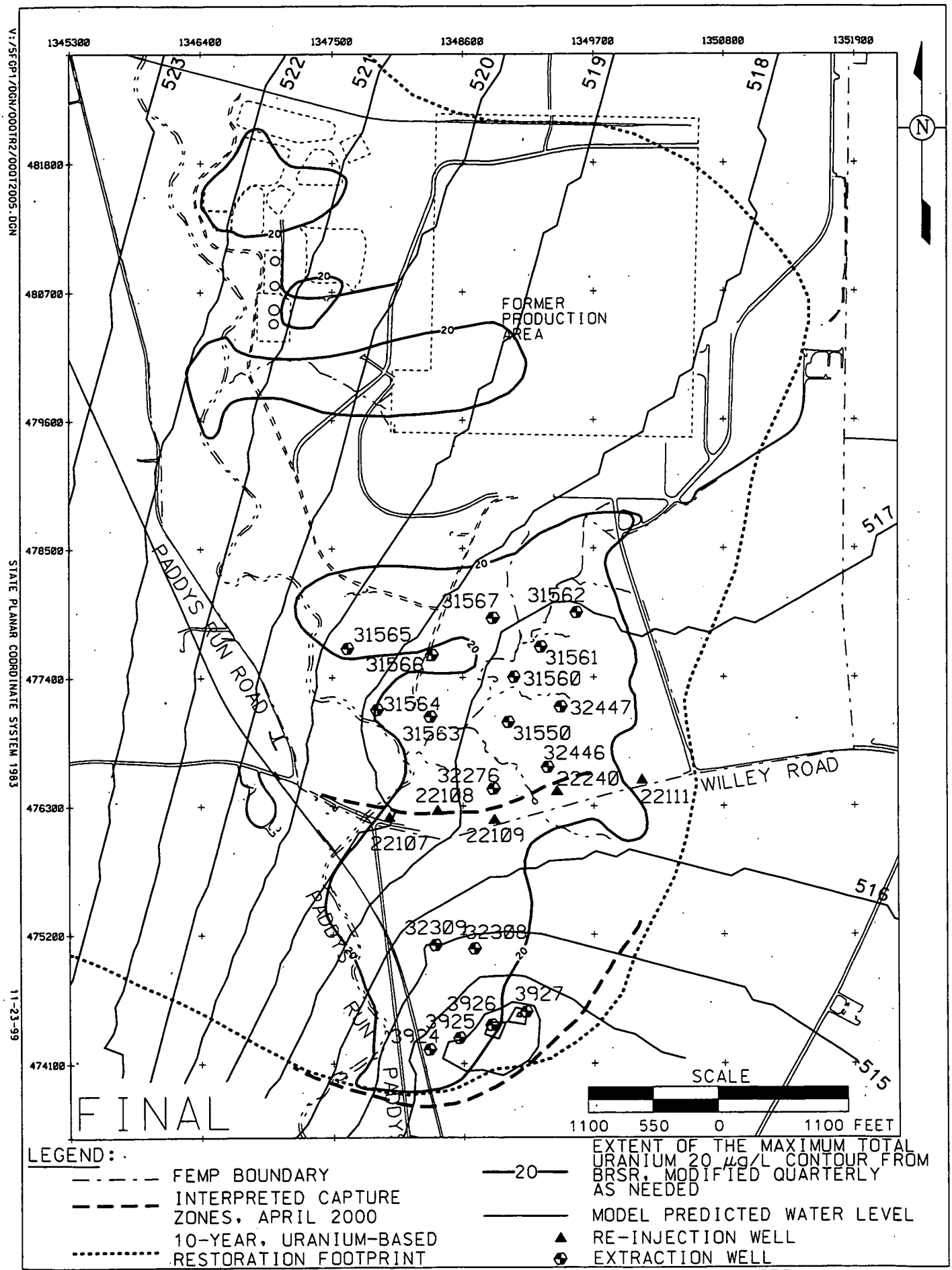


FIGURE 1-33. ROUTINE GROUNDWATER ELEVATIONS FOR TYPE 2 WELLS, APRIL 2000



000062

FIGURE 1-34. COMPARISON OF MODELED GROUNDWATER ELEVATIONS WITH INTERPRETED CAPTURE ZONES

On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring

2.0 ON-SITE DISPOSAL FACILITY GROUNDWATER/LEAK DETECTION AND LEACHATE MONITORING

This section summarizes the second quarter 2000 leachate collection system (LCS) and leak detection system (LDS) volume data and first quarter 2000 analytical results from the on-site disposal facility leak detection sampling activities. The material in this section satisfies the groundwater reporting requirements presented in the Integrated Environmental Monitoring Plan (IEMP), Revision 1 (DOE 1999a).

Figure 2-1 shows the sampling activities that contributed data to this section. Figure 2-2 identifies the well locations associated with the on-site disposal facility.

Figure 2-1 also shows the on-site disposal facility leak detection monitoring activities to be summarized in the next IEMP quarterly status report to be submitted in December of 2000. The report will contain LCS and LDS volume data from July through September 2000 (third quarter), and analytical results from on-site disposal facility leak detection sampling activities conducted from April through June 2000 (second quarter).

2.1 CELL 1

Placement of contaminated soil and debris in Cell 1 continued during the second quarter. At the end of June, Cell 1 was approximately 94 percent full.

2.1.1 CELL 1 LEAK DETECTION SYSTEM VOLUMES

Accumulation rates in the Cell 1 LDS primary containment vessel during the second quarter of 2000 were such that no pump outs were required (0 gallons pumped during the quarter).

Figure 2-3 depicts quantitative weekly measurements of the LDS water accumulation rates along with summary statistics (minimum, maximum, and average) for the quarter. Figure 2-3 also provides the weekly precipitation amounts corresponding to each accumulation period. The precipitation data are included in an effort to determine if a correlation exists between precipitation and the LDS accumulation rate. Based on review of Figure 2-3, it does not appear that there is a correlation between precipitation and the Cell 1 LDS accumulation rates.

The accumulation rates for the second quarter ranged from -0.04 gallons per acre per day (gpad) to 0.09 gpad with an average of 0.04 gpad. The second quarter average is considerably lower than the first quarter average of 0.13 gpad. The LDS accumulation rate at the end of the quarter was 0.09 gpad. This equates to a yield of about 2/3-pint of water per acre per day. The ongoing accumulation rate measurements indicate that the liner system for Cell 1 continues to perform such that the accumulation rates are far below (quarterly average is more than two orders of magnitude below) the on-site disposal facility design-established initial response leakage rate of 20 gpad.

2.1.2 CELL 1 ANALYTICAL STATUS

Sampling continues to be conducted in accordance with the On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring Plan (DOE 1997b) and follows agreements associated with that plan. Figure 2-2 identifies the well locations.

For the first quarter of 2000, the following samples were collected: one sample each of leachate (location 12338C) and LDS water (location 12338D); a baseline sampling event for perched groundwater (Horizontal Till Well 12338), and quarterly samples from the upgradient Great Miami Aquifer Monitoring Well 22201, and downgradient Great Miami Aquifer Monitoring Well 22198. Table 2-1 provides detected results for the quarter along with a summary of previous data for those constituents. The following summarizes the types of information provided in the table:

- Constituents posted on Table 2-1 were detected during the reporting period (first quarter) in at least one of the four monitored horizons (i.e., LCS, LDS, horizontal till well, or one of the Great Miami Aquifer wells).
- For each monitored horizon and each constituent detected during the reporting period, the following four pieces of information are provided:
  - Row 1, Column 1, total number of samples with detections since sampling began at that monitoring point / total number of samples analyzed since sampling began at that monitoring point
  - Row 1, Column 2, range of results from monitoring point since sampling began at that monitoring point
  - Row 2, Column 1, total number of samples with detections for the reporting period
  - Row 2, Column 2, range of results from the monitoring point for the reporting period.

The data in Table 2-1 generally indicate, as expected, progressively decreasing concentrations of the detected constituents from the LCS to the LDS to the horizontal till well. These decreasing concentrations, in conjunction with the very low LDS accumulation rate (approximately 2/3-pint per acre per day) indicate that the Cell 1 liner system is performing within the constraints established in the approved design.

Trend analysis will be performed annually on the analytical data collected from the LCS and LDS and will be provided in IEMP annual integrated site environmental reports. Horizontal till well results will continue to be reported quarterly and annually. Horizontal till well results will be provided annually on updated control charts once those charts are established in 2001. The Great Miami Aquifer monitoring well results will continue to be reported quarterly as presented in this report and in IEMP annual integrated site environmental reports on updated control charts, once those charts are established in 2001.

2.2 CELL 2

Placement of contaminated soil and debris in Cell 2 continued during the second quarter. At the end of June, Cell 2 was approximately 50 percent full.

2.2.1 CELL 2 LEAK DETECTION SYSTEM VOLUMES

Volumes pumped from the Cell 2 LDS for the second quarter of 2000 are as follows: April (0 gallons); May (284.0 gallons); and June (313.1 gallons).

Figure 2-4 depicts quantitative weekly measurements of the LDS water accumulation rates along with summary statistics (minimum, maximum, and average) for the quarter. Figure 2-4 also provides the weekly precipitation amounts corresponding to each accumulation period. The precipitation data are included in an effort to determine if a correlation exists between precipitation and the LDS accumulation rate.

Based on review of Figure 2-4, there does not appear to be a strong correlation of precipitation and the Cell 2 LDS accumulation rates during the second quarter. However, as reported in the Integrated Environmental Monitoring Status Report for First Quarter 2000 (DOE 2000b), during January and February 2000, the Cell 2 LDS accumulation rates appeared to increase concurrently with or just after the rainfall event. In March, and during the second quarter, the LDS accumulation rates seemed to be on a relatively steady increase that peaked for the quarter with the June 21 measurement. During the second quarter, observation of the Cell 2 catchment area and LCS flow rates indicated that the geotextile filter below the catchment area had become somewhat clogged with sediment and was not freely draining. The clogging of the filter below the catchment area may or may not be related to the increase in the flow rates from the Cell 2 LDS. However, measures to remove the sediments and restore the drainage capacity of the geotextile were completed in late July 2000.

The accumulation rates for the second quarter ranged from 0.20 to 2.24 gpad with an average of 1.12 gpad. The second quarter average is higher than the first quarter 2000 maximum of 0.50 gpad. Although higher than the first quarter, the ongoing accumulation rate measurements indicate that the liner system for Cell 2 continues to perform such that the accumulation rates are far below the on-site disposal facility design-established initial response leakage rate of 20 gpad (quarterly average is less than six percent of the initial response rate).

2.2.2 CELL 2 ANALYTICAL STATUS

Sampling continues to be conducted in accordance with the On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring Plan and follows agreements associated with that plan. Figure 2-2 identifies the well locations.

For the first quarter of 2000, the following samples were collected: one sample each of leachate (location 12339C) and LDS water (location 12339D); and baseline sampling events for perched groundwater (Horizontal Till Well 12339), upgradient Great Miami Aquifer Monitoring Well 22200, and downgradient Great Miami Aquifer Monitoring Well 22199. Table 2-2 provides detected results for the quarter along with a summary of previous data for those constituents. The following summarizes the types of information provided in the table:

- Constituents posted on Table 2-2 were detected during the reporting period (first quarter) in at least one of the four monitored horizons (i.e., LCS, LDS, horizontal till well, or one of the Great Miami Aquifer wells).
- For each monitored horizon and each constituent detected during the reporting period, the following four pieces of information are provided:
  - Row 1, Column 1, total number of samples with detections since sampling began at that monitoring point / total number of samples analyzed since sampling began at that monitoring point
  - Row 1, Column 2, range of results from monitoring point since sampling began at that monitoring point
  - Row 2, Column 1, total number of samples with detections for the reporting period
  - Row 2, Column 2, range of results from the monitoring point for the reporting period.

Trend analysis will be performed annually on the analytical data collected from the LCS and LDS and will be provided in IEMP annual integrated site environmental reports. Horizontal till well results will continue to be reported quarterly and annually. Horizontal till well results will be provided annually on updated control charts once those charts are established in early 2001. The Great Miami Aquifer monitoring well results will continue to be reported quarterly as presented in this report and in IEMP annual integrated site environmental reports.

Note that the LDS total organic carbon and total uranium concentrations are still greater than those found in the LCS sample for the quarter. This indicates that the residual contamination from the water that backed up in the system continues to confound the interpretation of the LDS analytical data. Also of note is the decrease in boron and total uranium concentrations when comparing the LDS results to the horizontal till well results for the quarter. These decreasing concentrations in conjunction with the second quarter 2000 LDS accumulation rates indicate that the Cell 2 liner system is performing within the constraints established in the approved design.

2.3 CELL 3

Placement of contaminated soil and debris in Cell 3 continued during the second quarter. At the end of June, Cell 3 was approximately 13 percent full.

2.3.1 CELL 3 LEAK DETECTION SYSTEM VOLUMES

No water accumulated in the Cell 3 LDS primary containment vessel during the second quarter of 2000; therefore, the water accumulation rate for the entire quarter is zero.

2.3.2 CELL 3 ANALYTICAL STATUS

Sampling continues to be conducted in accordance with the On-Site Disposal Facility Groundwater/Leak Detection and Leachate Monitoring Plan and follows agreements associated with that plan. Figure 2-2 identifies the well locations.

For the first quarter of 2000, the following samples were collected: one sample each of leachate (location 12340C); a baseline sampling event for perched groundwater (Horizontal Till Well 12340), and quarterly samples from the upgradient Great Miami Aquifer Monitoring Well 22203, and downgradient Great Miami Aquifer Monitoring Well 22204. The Cell 3 LDS (location 12338D) did not yield any water, therefore a LDS sample was not collected. Table 2-3 provides detected results for the quarter along with a summary of previous data for those constituents. The following summarizes the types of information provided in the table:

- Constituents posted on Table 2-3 were detected during the reporting period (first quarter) in at least one of the four monitored horizons (i.e., LCS, horizontal till well, or one of the Great Miami Aquifer wells).
- For each monitored horizon and each constituent detected during the reporting period, the following four pieces of information are provided:
  - Row 1, Column 1, total number of samples with detections since sampling began at that monitoring point / total number of samples analyzed since sampling began at that monitoring point
  - Row 1, Column 2, range of results from monitoring point since sampling began at that monitoring point
  - Row 2, Column 1, total number of samples with detections for the reporting period
  - Row 2, Column 2, range of results from the monitoring point for the reporting period.

The data in Table 2-3 generally indicate, as expected, decreasing concentrations of the detected constituents from the LCS to the horizontal till well. These decreasing concentrations, in conjunction with the lack of water yield in the Cell 3 LDS indicate that the Cell 3 liner system is performing within the constraints established in the approved design.

Trend analysis will be performed annually on the analytical data collected from the LCS and LDS (if the LDS yields water) and will be provided in IEMP annual integrated site environmental reports. Horizontal till well results will continue to be reported quarterly and annually. Horizontal till well results will be provided annually on updated control charts once those charts are established in 2001. The Great Miami Aquifer monitoring well results will continue to be reported quarterly as presented in this report and in IEMP annual integrated site environmental reports on updated control charts, once those charts are established in 2001.

2.4 CELL 4

2.4.1 CELL 4 ANALYTICAL STATUS

Baseline sampling of Monitoring Wells 2421 and 22205 is scheduled to begin the summer of 2000.

2.5 LEACHATE COLLECTION SYSTEM VOLUMES

Volumes from the LCS for the second quarter of 2000 are as follows: April (1,495,211 gallons); May (386,360 gallons); and June (1,244,187 gallons).

TABLE 2-1

ON-SITE DISPOSAL FACILITY CELL 1 DATA SUMMARY FOR CONSTITUENTS DETECTED DURING FIRST QUARTER 2000

Note: Non-italicized pertains to total number of samples (including first quarter samples).
Italicized pertains to first quarter samples only.

Constituent (FRL)[a]	LCS[b,c,d,e] (12338C)		LDS[b,c,d,e] (12338D)		HTW[b,c,d,e] (12338)		Great Miami Aquifer			
							Upgradient[b,c,d] (22201)		Downgradient[b,c,d] (22198)	
	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range
Total Organic Carbon (NA[f] mg/L)	7/9	ND to 123	6/8	ND to 80.9	25/27	ND to 12.2	21/24	ND to 59.7	20/24	ND to 52.5
	1/1	*21.3*	*1/1*	*15.7*	*1/1*	*7.24*	*1/1*	*12.4*	*1/1*	*13*
Boron (0.33 mg/L)	10/10	0.0642 to 2.8	8/8	0.0296 to 0.321	21/27	ND to 0.685	19/24	ND to 0.142	26/34	ND to 0.116
	1/1	*1.72*	*1/1*	*0.234*	*1/1*	*0.083*	*1/1*	*0.108*	*2/2*	0.0599 to 0.0627
Technetium-99 (94.0 pCi/L)	3/9	ND to 18.28	1/8	ND to 8.92	7/28	ND to 21.1	1/24	ND to 13.41	2/34	ND to 14.8
	1/1	*12.374*	*0/1*	*ND*	*0/1*	*ND*	*0/1*	*ND*	*0/2*	*ND*
Total Uranium (20 µg/L)	8/9	ND to 119	8/8	1.5 to 20.17	27/28	ND to 19	20/24	ND to 5.196	34/34	0.557 to 3.814
	1/1	*106.4346*	*1/1*	*15.4236*	*1/1*	*1.72*	*0/1*	*ND*	*2/2*	*1.1522 to 1.8069*

[a]From Operable Unit 5 Record of Decision, Table 9-4
[b]If there was more than one sample result per day (e.g., a duplicate sample), then only the maximum sample concentration was counted and compared to the FRL.
[c]Rejected data qualified with either a R or Z were not used in this comparison.
[d]ND = not detected
[e]LCS = leachate collection system
LDS = leak detection system
HTW = horizontal till well
[f]NA = not applicable

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TABLE 2-2

ON-SITE DISPOSAL FACILITY CELL 2 DATA SUMMARY FOR CONSTITUENTS DETECTED DURING FIRST QUARTER 2000

Note: Non-italicized pertains to total number of samples (including first quarter samples).
Italicized pertains to first quarter samples only.

Constituent (FRL)[a]	LCS[b,c,d,e] (12339C)		LDS[b,c,d,e] (12339D)		HTW[b,c,d,e] (12339)		Great Miami Aquifer: Upgradient[b,c,d] (22200)		Great Miami Aquifer: Downgradient[b,c,d] (22199)	
	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range
Total Organic Carbon (NA[f] mg/L)	4/6	ND to 6.25	6/7	ND to 26.1	21/25	ND to 11.1	17/19	ND to 47.6	15/19	ND to 51.8
	1/1	*6.25*	*1/1*	*11.5*	*1/1*	*11.1*	*1/1*	*14.4*	*1/1*	*9.68*
Boron (0.33 mg/L)	6/7	ND to 0.915	6/6	0.396 to 2.22	15/25	ND to 0.0829	13/19	ND to 0.158	13/19	ND to 0.0569
	1/1	*0.448*	*1/1*	*0.396*	*1/1*	*0.0388*	*1/1*	*0.0606*	*1/1*	*0.0497*
Total Uranium (20 µg/L)	7/7	4.51 to 24.1231	6/6	12 to 71	25/26	ND to 3.607	13/19	ND to 1.11	19/19	0.259 to 12.1
	1/1	*24.1231*	*1/1*	*24.7613*	*1/1*	*2.5603*	*1/1*	*0.3676*	*1/1*	*0.9446*

[a]From Operable Unit 5 Record of Decision, Table 9-4
[b]If there was more than one sample result per day (e.g, a duplicate sample), then only the maximum sample concentration was counted and compared to the FRL.
[c]Rejected data qualified with either a R or Z were not used in this comparison.
[d]ND = not detected
[e]LCS = leachate collection system
LDS = leak detection system
HTW = horizontal till well
[f]NA = not applicable

TABLE 2-3

ON-SITE DISPOSAL FACILITY CELL 3 DATA SUMMARY FOR CONSTITUENTS DETECTED DURING FIRST QUARTER 2000

Note: Non-italicized pertains to total number of samples (including first quarter samples).
Italicized pertains to first quarter samples only.

	LCS (12340C)		HTW[b,c,d,e] (12340)		Great Miami Aquifer			
					Upgradient[b,c,d] (22203)		Downgradient[b,c,d] (22204)	
Constituent (FRL)[a]	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range	No. of Samples with Detections / No. of Samples	Range
Total Organic Carbon (NA[f] mg/L)	2/3	ND to 34.2	11/21	ND to 9.81	6/17	ND to 5.66	7/17	ND to 8.83
	1/1	*3.14*	*1/1*	*9.81*	*1/1*	*5.66*	*1/1*	*8.83*
Boron (0.33 mg/L)	3/3	0.268 to 0.496	17/20	ND to 0.24	11/17	ND to 0.0776	10/17	ND to 0.179
	1/1	*0.291*	*1/1*	*0.138*	*1/1*	*0.0494*	*1/1*	*0.048*
Total Uranium (20 µg/L)	3/3	9.27 to 11.5	18/20	ND to 9.14	12/17	ND to 0.907	16/17	ND to 2.995
	1/1	*9.3481*	*1/1*	*5.4502*	*1/1*	*0.7486*	*1/1*	*0.418*

[a]From Operable Unit 5 Record of Decision, Table 9-4
[b]If there was more than one sample result per day (e.g., a duplicate sample), then only the maximum sample concentration was counted and compared to the FRL.
[c]Rejected data qualified with either a R or Z were not used in this comparison.
[d]ND = not detected
[e]HTW = horizontal till well
[f]NA = not applicable

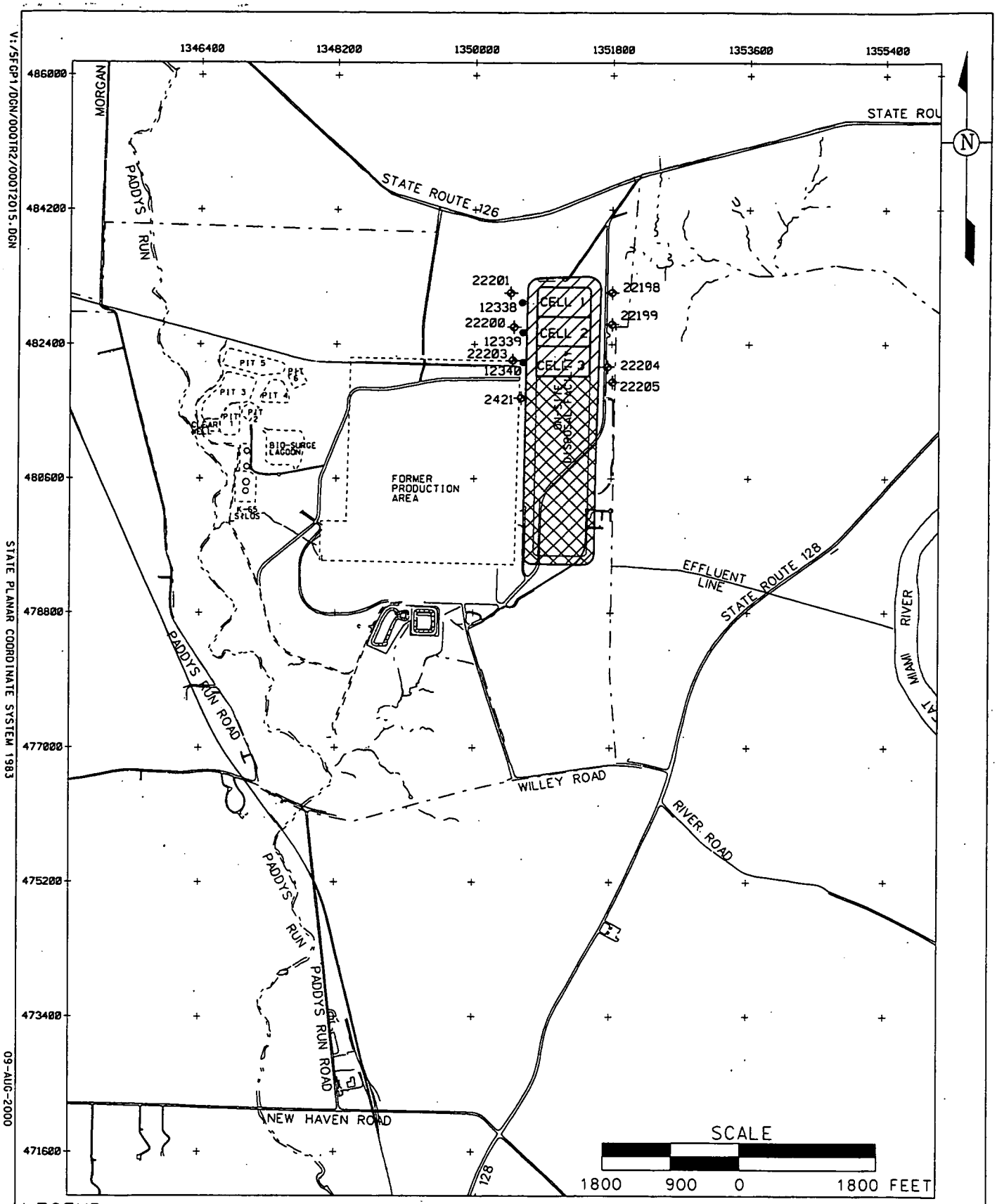
FIGURE 2-1

ON-SITE DISPOSAL FACILITY LEAK DETECTION ACTIVITIES

LEAK DETECTION ACTIVITIES	Quarter/Year											
	First Quarter/2000			Second Quarter/2000			Third Quarter/2000			Fourth Quarter/2000		
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Cell 1												
LDS Volumes				◆	◆	◆	☒	☒	☒			
Analytical	◆	◆	◆	☒	☒	☒						
Cell 2												
LDS Volumes				◆	◆	◆	☒	☒	☒			
Analytical	◆	◆	◆	☒	☒	☒						
Cell 3												
LDS Volumes				◆	◆	◆	☒	☒	☒			
Analytical	◆	◆	◆	☒	☒	☒						
LCS Volumes				◆	◆	◆	☒	☒	☒			

◆ Data summarized/evaluated in this report
☒ Data summarized/evaluated in the next report

FINAL



LEGEND:

- FEMP BOUNDARY
- OSDF MONITORING WELL IN GREAT MIAMI AQUIFER
- HORIZONTAL TILL WELL
- EXISTING CELLS
- ANTICIPATED FUTURE CELLS

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FIGURE 2-2. ON-SITE DISPOSAL FACILITY FOOTPRINT AND MONITORING WELL LOCATIONS

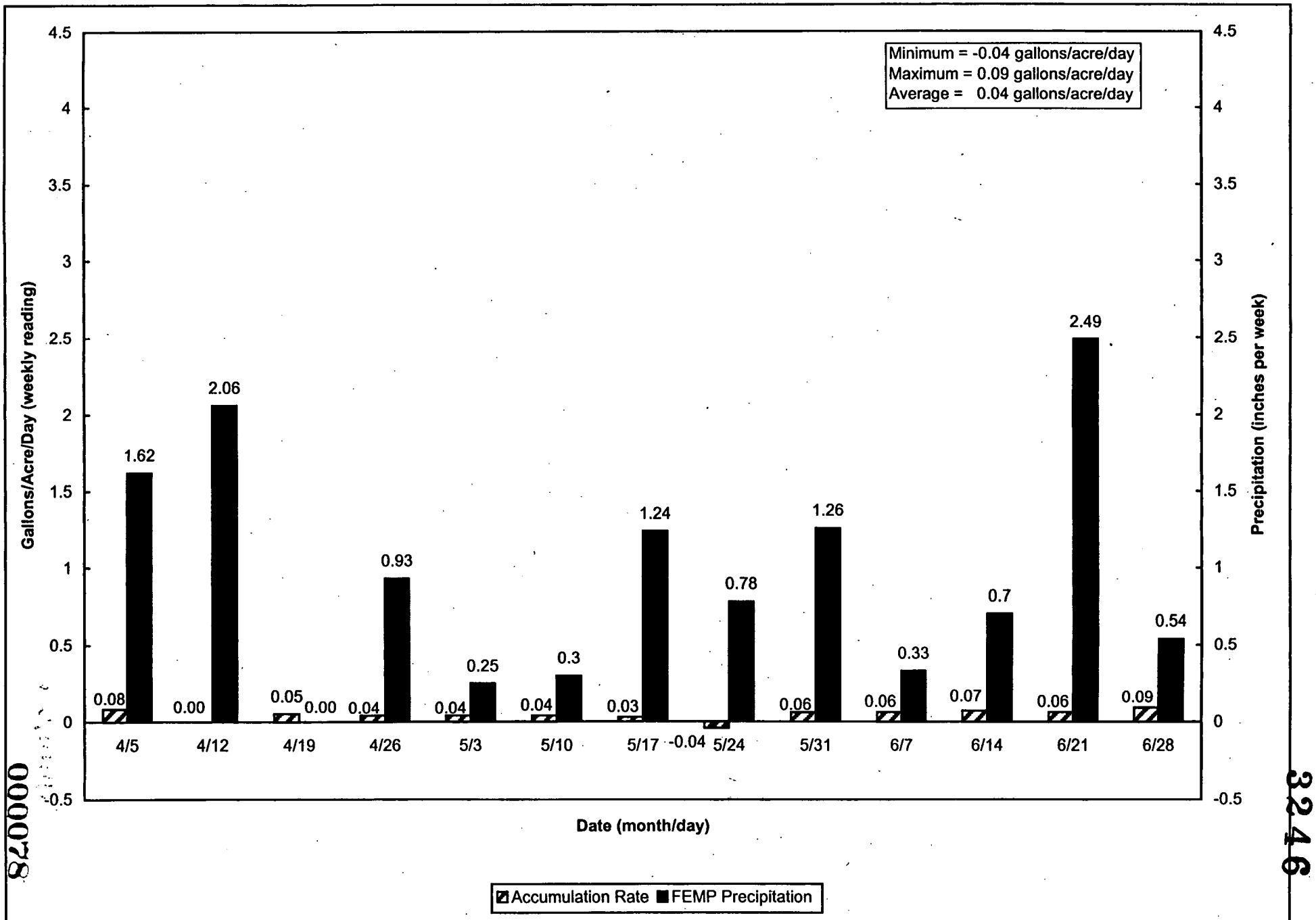

FIGURE 2-3. ON-SITE DISPOSAL FACILITY LDS ACCUMULATION RATES FOR CELL 1

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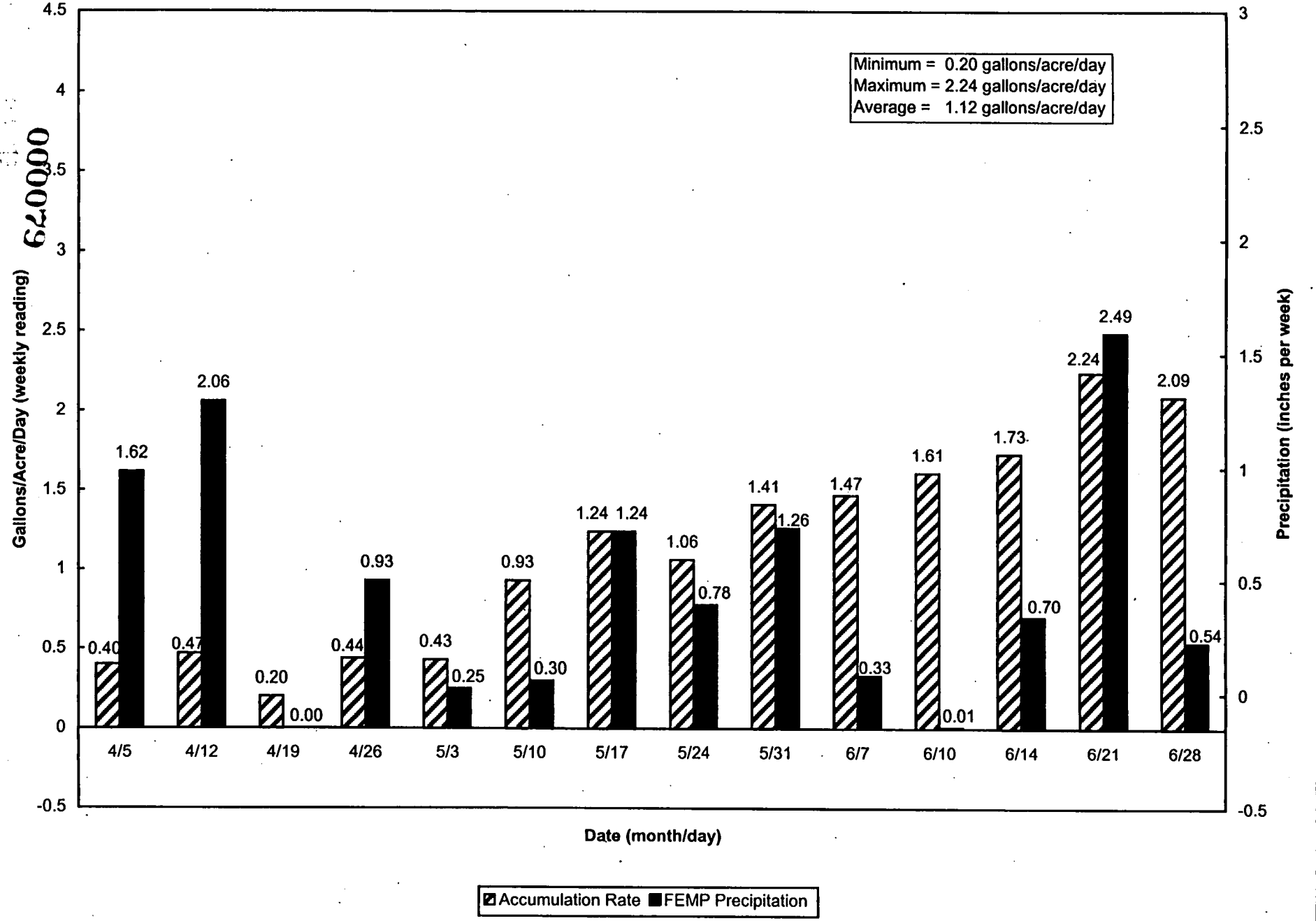


FIGURE 2-4. ON-SITE DISPOSAL FACILITY LDS ACCUMULATION RATES FOR CELL 2

Surface Water and Treated Effluent

3.0 SURFACE WATER AND TREATED EFFLUENT

This section provides a status of the surface water and treated effluent monitoring for the second quarter of 2000. Figure 3-1 shows the data included in this section. Figure 3-2 identifies the surface water and treated effluent sample locations. Analytical results from the following routine monitoring program elements were utilized to complete the reporting requirements identified in Section 4.6.2 of the Integrated Environmental Monitoring Plan (IEMP), Revision 1 (DOE 1999a):

- National Pollutant Discharge Elimination System (NPDES) permit (data obtained from April through June 2000)
- Federal Facilities Compliance Agreement (FFCA) requirements (data obtained from April through June 2000)
- IEMP Characterization Program results (data obtained from January through March 2000).

Figure 3-1 also shows the data from the surface water and treated effluent sampling activities that will be included in the next IEMP quarterly status report to be submitted in December of 2000. The report will contain NPDES and FFCA data from July through September 2000 (third quarter) and analytical data from the IEMP Characterization Program from April through June 2000 (second quarter).

3.1 NPDES PERMIT COMPLIANCE

Figure 3-3 identifies the surface water and treated effluent sample locations associated with NPDES compliance monitoring. In April of 2000 the Fernald site experienced two noncompliances of the total suspended solids concentration at the sewage treatment plant (daily maximum and monthly average). These noncompliances were related to difficulties in controlling total suspended solids in the sewage treatment process. Further explanation is provided in the noncompliance report that was provided to the Ohio Environmental Protection Agency (OEPA) (reference Letter No. C:SWP(ARWWP):2000-0010, dated May 11, 2000). There were no noncompliances with the NPDES Permit during May or June.

3.2 FFCA AND OU5 ROD COMPLIANCE

Figure 3-4 shows that a cumulative total of 135.8 pounds of uranium were discharged to the Great Miami River in effluent from January through June 2000. The Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996) established an annual discharge limit to the Great Miami River of 600 pounds for total uranium.

Uncontrolled runoff also contributes to the amount of total uranium entering the environment. A loading term has been established to estimate the amount of uranium discharged through uncontrolled runoff based on the amount of rainfall measured. The loading term used is 2.6 pounds of uranium discharged per inch of rainfall. Figure 6-1 shows that precipitation during the second quarter of 2000 was 12.56 inches; therefore, the mass of total uranium discharged to Paddys Run through uncontrolled runoff from April through June 2000 is estimated to be 32.66 pounds.

Figure 3-5 illustrates that the monthly average total uranium concentration limit of 20 micrograms per liter for water discharged to the Great Miami River was met each month during the second quarter of 2000. There were no changes to Table 3-1 because no treatment plant maintenance or significant precipitation bypass events occurred during the second quarter of 2000.

Figure 3-6 presents controlled and uncontrolled surface water flow areas for the second quarter of 2000. As identified in previous IEMP quarterly status reports, an evaluation of controlled areas is to occur at least quarterly in order to help ensure that the appropriate areas are being controlled. There were no changes from that depicted in the Integrated Environmental Monitoring Status Report for First Quarter 2000 (DOE 2000b).

3.3 SURVEILLANCE MONITORING

The following activities occurred during the second quarter of 2000 that could have potentially impacted the water quality at various surface water sample locations (identified in parentheses):

- Limited activities in the on-site disposal facility borrow area (SWD-02 and STRM 4003)
- Waste placement activities associated with on-site disposal facility Cells 1, 2, and 3 (PF 4001)
- Stabilization activities associated with the remaining lead contaminated soil in the trap range in Area 1, Phase II (SWD-02 and STRM 4003)
- Began and completed excavation of "radium hot spot" in Area 2, Phase III (SWD-02, STRM 4003, and PF 4001)
- Excavation activities associated with Soil Pile 3 (STRM 4003) and Soil Piles 2 and 4 (PF 4001)
- Excavation of southern waste unit material and hauling of excavated materials to the on-site disposal facility via the impacted material haul road (STRM 4004, STRM 4005, and PF 4001)
- Continuation of full scale operations at the Waste Pits Remedial Action Project (WPRAP) including excavation, processing, and drying of waste pit material and other general support activities (PF 4001, SWD-03, and STRM 4005)
- Loading of contaminated material in support of the WPRAP activities (STRM 4005, PF 4001, and SWD-03)
- Rail yard activities in support of the loading and shipping of railcars (STRM 4006 and SWP-02)
- Construction and planting activities associated with the Area 8, Phase II Ecological Restoration Project (SWP-02)
- Initiation of site preparation activities associated with the Operable Unit 4 Accelerated Waste Retrieval and Silo 3 Stabilization Projects (SWD-03 and STRM 4005).

All required samples from the surface water and treated effluent locations were collected during the first and second quarters. Based on a review of the surface water data associated with this report (Figure 3-1), there were two final remediation level (FRL) exceedances experienced (Table 3-2). One exceedance occurred at new NPDES location 4801 (IEMP monitoring point SWR-01). This exceedance was for lead collected and reported under the NPDES Permit in the June 2000 Discharge Monitoring Report. However, this is a background location (i.e., it is upstream of the Fernald site's discharge), and therefore can not be associated with Fernald site activities.

On February 15, 2000, the second exceedance of the first quarter occurred for zinc at location SWD-03. The result of 0.126 milligrams per liter (mg/L) was above the established FRL of 0.11 mg/L. This is the first exceedance identified for zinc at this location. While a definitive cause has not been established, there was a discharge of storm water from the

WPRAP Storm Water Management Pond to Paddys Run on this day. However, data submitted to characterize the Storm Water Management Pond in April 1999 in support of the NPDES Permit show a low concentration of zinc (0.008 mg/L) (reference Letter No. DOE-0613-99 from the U.S. Department of Energy to OEPA, dated April 23, 1999).

Previous IEMP quarterly status reports have included discussion of turbidity monitoring in Paddys Run as related to the state threatened Sloan's crayfish within the Natural Resources Monitoring Section. However, this information will now be included here under surface water surveillance monitoring.

Several actions were initiated and completed during the second quarter. A field investigation was completed on April 7, 2000, the intent of which was to try and identify any areas of turbid runoff entering the rail yard sedimentation basin. A walk down on the western side of the on-site disposal facility and rail yard drainage channels revealed no highly turbid water entering the area.

A limited sampling program was initiated within the rail yard area. Six locations were selected for which turbidity, total suspended solids, and uranium (dissolved and total) samples will be collected to ascertain if an identifiable source of both uranium and turbidity can be located; and if possible, the degree to which turbidity and uranium are related. The investigation of uranium is in response to the OEPA's sampling program downstream of the railroad bridge indicating an upward trend in uranium concentrations. While OEPA's data indicate an upward trend, their data do not indicate that an exceedance of a surface water FRL is occurring. This sampling program was not completed as of June 30, 2000.

The routine turbidity monitoring continued in the second quarter of 2000, and no unexpected conditions were observed. There were nine observations made during the second quarter and none of the observations indicated more turbid conditions in the northern drainage ditch compared to the flow in Paddys Run. As mentioned in the Integrated Environmental Monitoring Status Report for First Quarter 2000, several corrective actions were conducted in the rail yard sedimentation basin in order to reduce the amount of sediment released after rain events. Eroded soil around an inlet pipe was repaired, and exposed soils were seeded. Observations will continue to determine the effectiveness of these actions.

TABLE 3-1

2000 STORM WATER RETENTION BASIN OVERFLOWS AND TREATMENT BYPASS EVENTS

Event	Duration (hours)	Number of Bypass Days[a]	Cumulative Number of Bypass Days	Total Uranium Discharged (pounds)	Total Water Discharged (millions of gallons)
Overflows				(to Paddys Run)	(to Paddys Run)
January 4	16.16	1	1	8.53	4.041
Significant Precipitation Bypasses				(to Great Miami River)	(to Great Miami River)
January 3 through January 5	39.67	1	1	4.19	2.455
February 18 through February 19	30.50	1	2	5.87	2.064

[a]Days are counted according to the definition provided in the Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Project (DOE 1999b).

TABLE 3-2

SURFACE WATER LOCATIONS WITH RESULTS ABOVE THE FRL, INCLUDING SUMMARY STATISTICS

Sample Location	Constituent	Total Number of Samples Since January 1, 1997[a,b,c]	Number of Samples with FRL Exceedances Since January 1, 1997[a,b,c]	Number of Samples with FRL Exceedances for First Quarter 2000[a,b,c]	FRL[d] (mg/L)	Summary Statistics[b,c,f] Min. (mg/L)	Max. (mg/L)	Avg. (mg/L)	Results with FRL Exceedances for First Quarter 2000 Sample Result (mg/L)	Validation Qualifier[g]	Sample Date
SWD-03 (Waste Storage Area)	Zinc	9	1	1	0.11	0.0033	0.126	0.031	0.126	J	2/15/00
SWR-01 (Great Miami River Background; NPDES Permit location STRM 4801)	Lead	12	2	1	0.01	0.0008	0.0222	0.0050	0.0151	NV	6/28/00

[a]Total number of samples is from all programs including NPDES, NPDES Permit, FFCA, and IEMP Characterization Program.
[b]If more than one sample is collected per surface water location per day (e.g., duplicate, grab, composite), then only one sample is counted for the total number of samples and the sample with the maximum concentration is used for the summary statistics and in determining FRL exceedances.
[c]Rejected data qualified with either a R or Z were not used for this table.
[d]From Operable Unit 5 Record of Decision , Table 9-5
[e]If the total number of samples is greater than or equal to three, then the minimum, maximum, and average are reported. If the total number of samples is equal to two, then the minimum and maximum are reported. If the total number of samples is equal to one, then none of the summary statistics are reported.
[f]For results where the concentrations are below the detection limit, the results used in the summary statistics are each set at half the detection limit.
[g]Validation qualifier codes are provided in Appendix D of the Sitewide CERCLA Quality Assurance Project Plan (DOE 1998).

FIGURE 3-1

SURFACE WATER AND TREATED EFFLUENT SAMPLING ACTIVITIES

SAMPLING ACTIVITIES[a]	Quarter/Year											
	First Quarter/2000			Second Quarter/2000			Third Quarter/2000			Fourth Quarter/2000		
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
NPDES				◆	◆	◆	☒	☒	☒			
FFCA				◆	◆	◆	☒	☒	☒			
IEMP Characterization	◆	◆	◆	☒	☒	☒						

◆ Data summarized/evaluated in this report
☒ Data summarized/evaluated in the next report

FINAL

[a]Some samples are collected to support more than one surface water sampling activity.

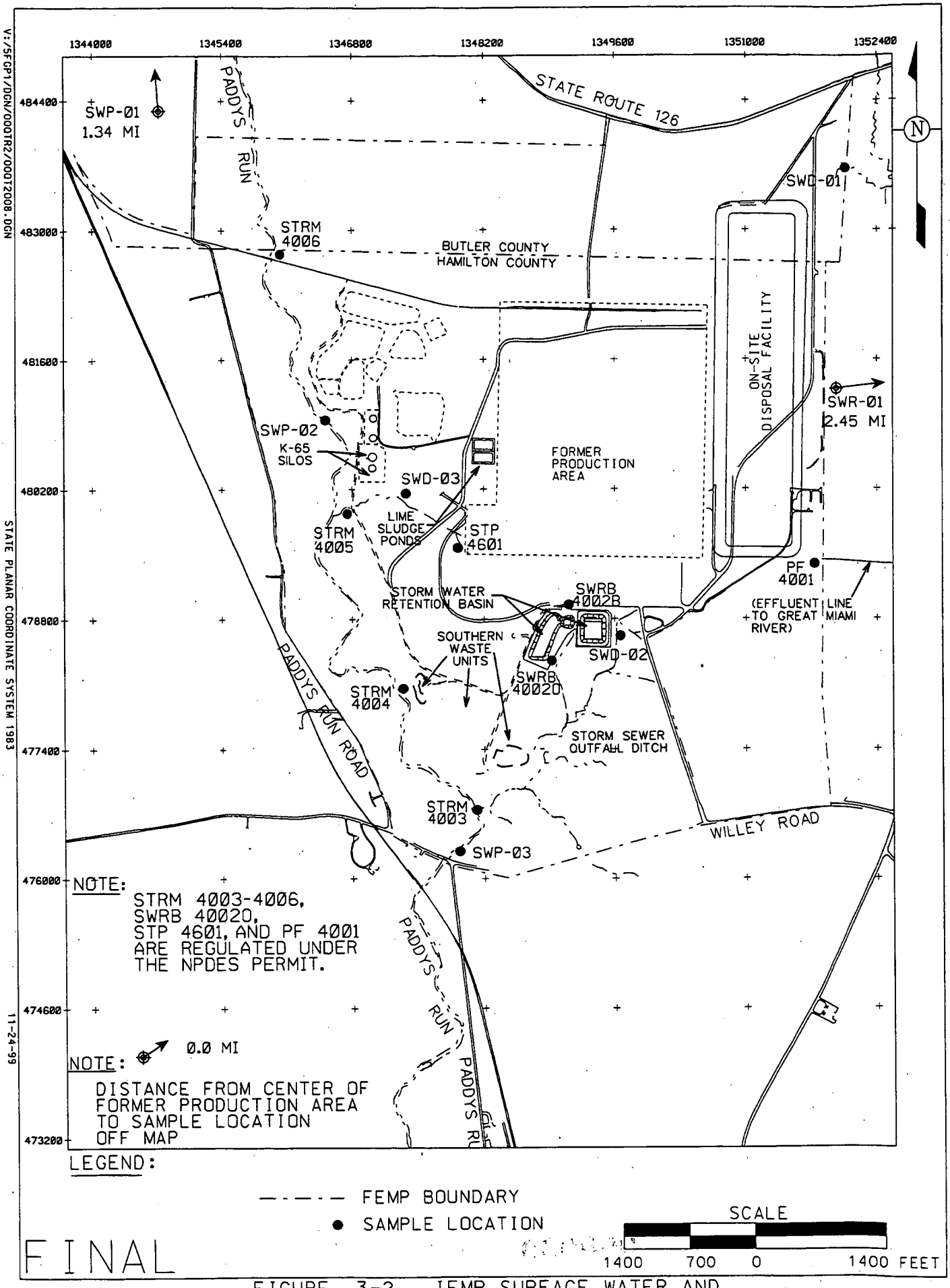


FIGURE 3-2. IEMP SURFACE WATER AND TREATED EFFLUENT SAMPLE LOCATIONS

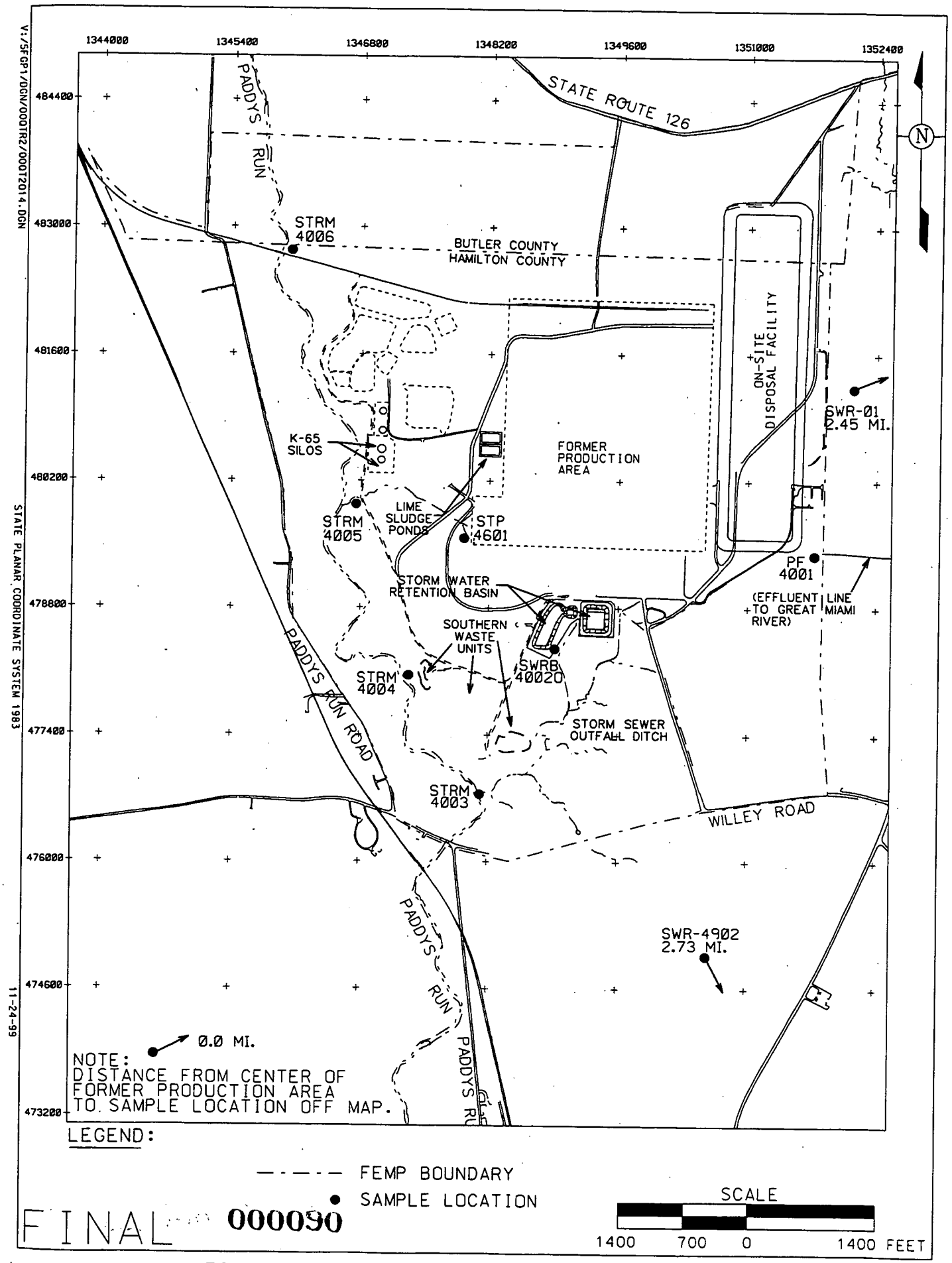
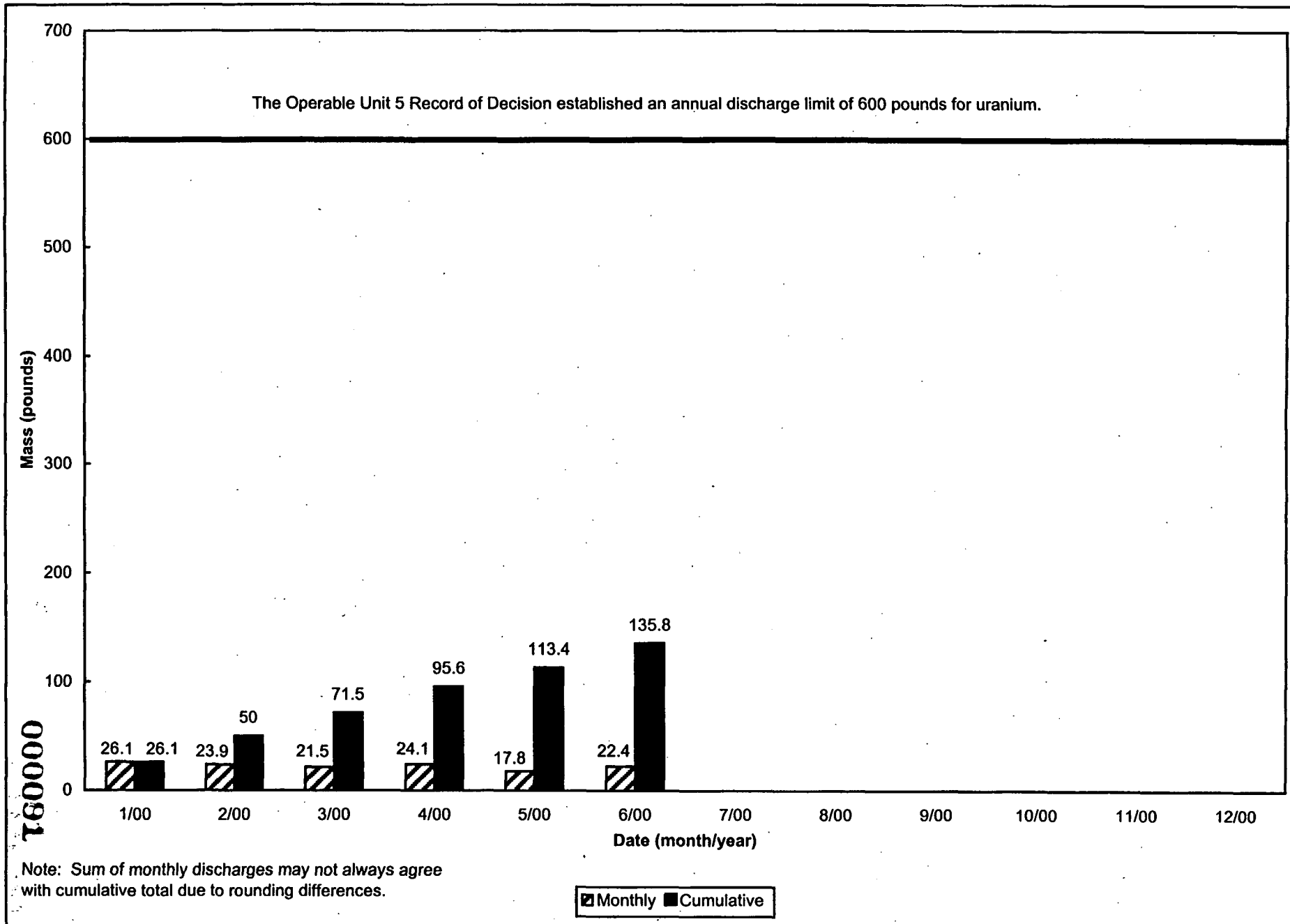


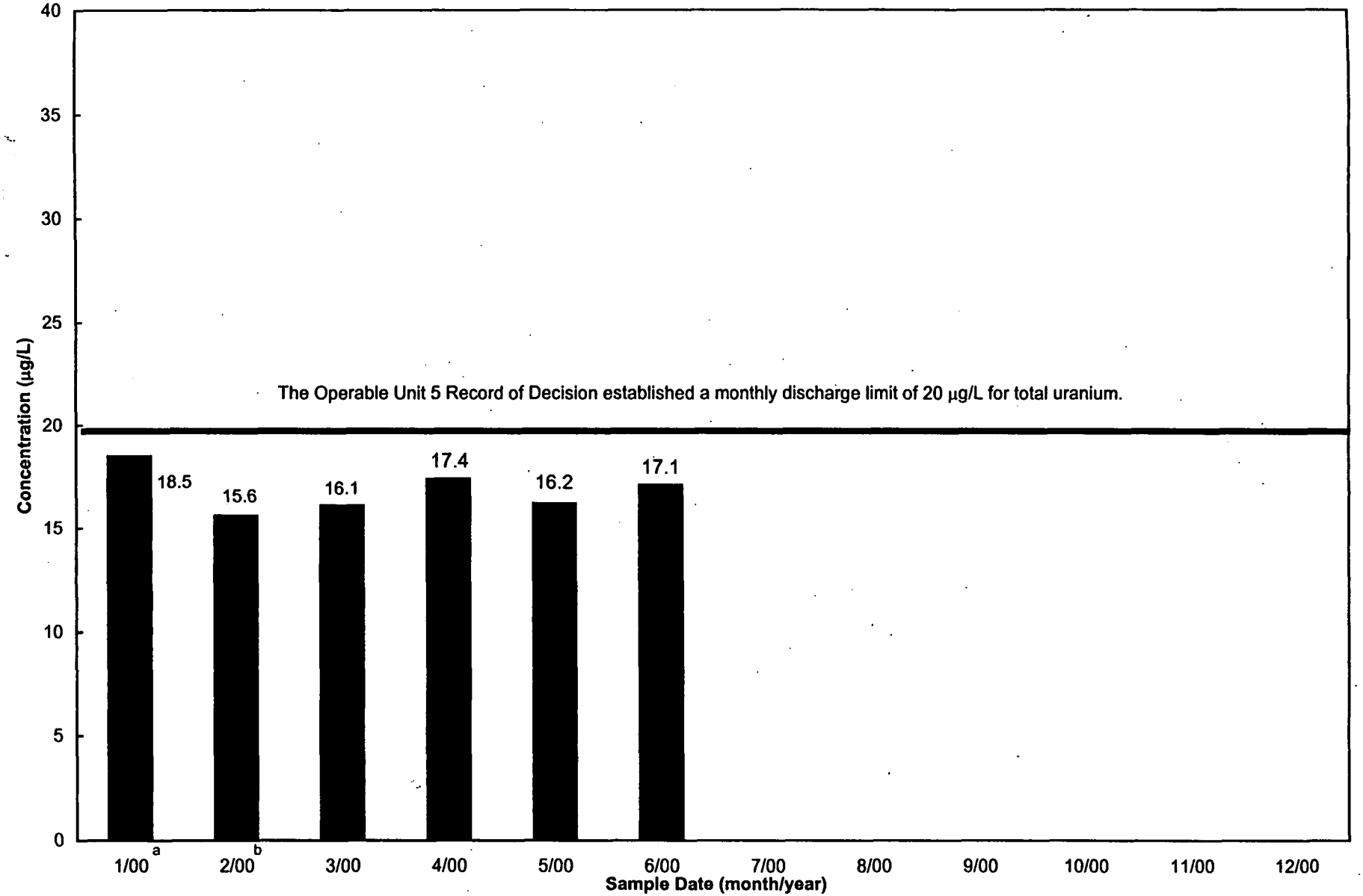
FIGURE 3-3. NPDES PERMIT SAMPLE LOCATIONS



Note: Sum of monthly discharges may not always agree with cumulative total due to rounding differences.

FINAL

FIGURE 3-4. POUNDS OF URANIUM DISCHARGED TO THE GREAT MIAMI RIVER FROM THE PARSHALL FLUME (PF 4001) IN 2000



[a]Actual concentration was 20.9 µg/L. Eliminating one "significant precipitation" bypass day reduces average to 18.5 µg/L.

[b]Actual concentration was 18.7 µg/L. Eliminating one "significant precipitation" bypass day reduces average to 15.6 µg/L.

FIGURE 3-5. 2000 MONTHLY AVERAGE TOTAL URANIUM CONCENTRATION IN WATER DISCHARGED FROM THE PARSHALL FLUME (PF 4001) TO THE GREAT MIAMI RIVER

FINAL

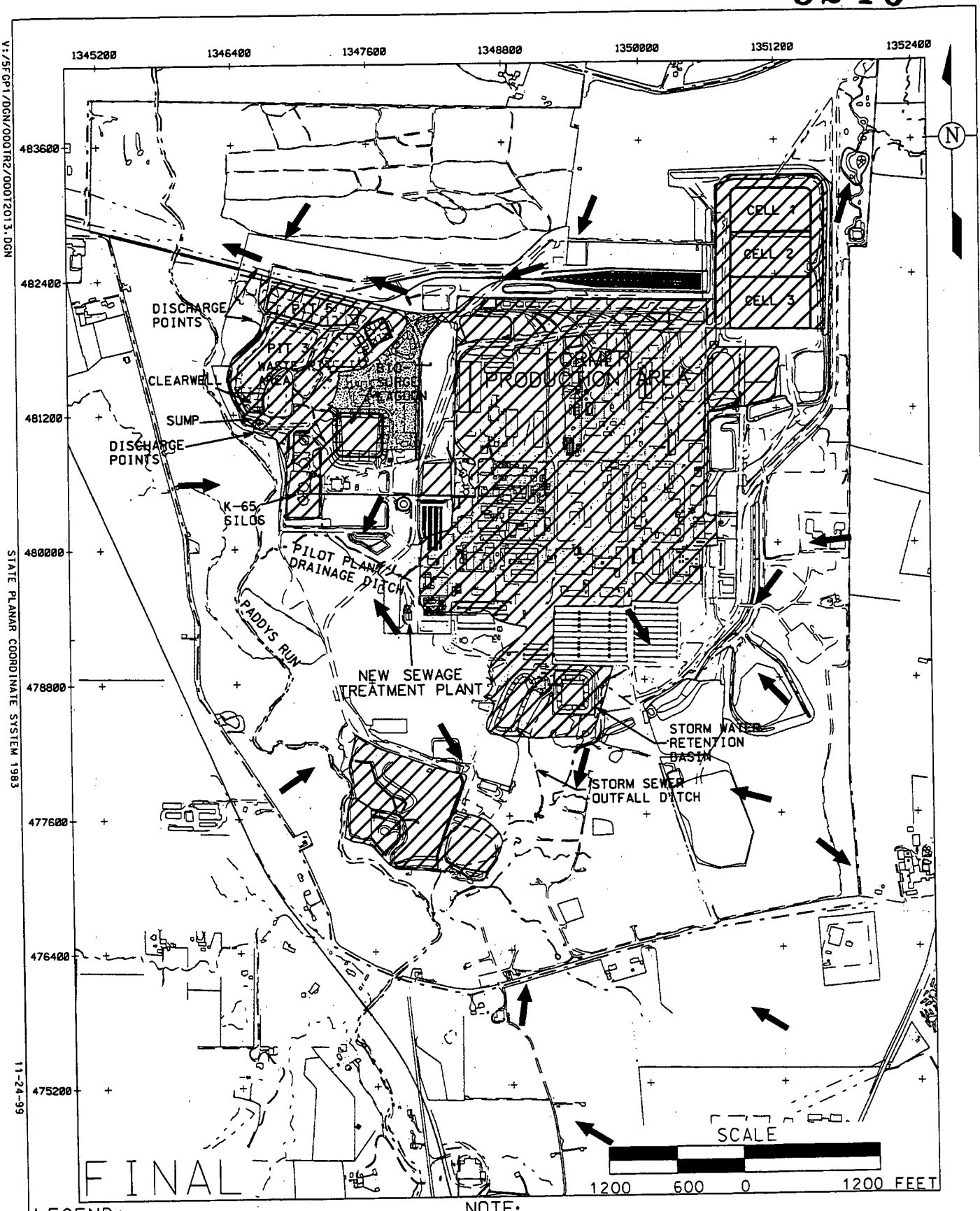


FIGURE 3-6. CONTROLLED SURFACE WATER AREAS AND UNCONTROLLED FLOW DIRECTIONS FOR SECOND QUARTER 2000

Air Monitoring

4.0 AIR MONITORING

This section provides a summary of the second quarter 2000 monitoring activities and analytical results for the Integrated Environmental Monitoring Plan (IEMP) air monitoring program. Figure 4-1 shows the data included in this section. Analytical results from the following routine air monitoring program elements and project-specific air monitoring activities covered in this section include:

- Radiological Air Particulate Monitoring:
  - National Emissions Standards for Hazardous Air Pollutants (NESHAP) Compliance
  - Monitoring Thorium Emissions from the Waste Pits Remedial Action Project (WPRAP)
- NESHAP Stack Emissions Monitoring
- Radon Monitoring:
  - Continuous Alpha Scintillation Monitoring - Silo Head Space and Environmental Data
- Direct Radiation Monitoring (via thermoluminescent dosimeters [TLDs]).

Figure 4-1 also shows the data from the air monitoring activities that will be included in the next IEMP quarterly status report to be submitted in December of 2000. The report will contain data from air monitoring activities from July through September 2000 (third quarter). Monitoring activities defined under the IEMP for radiological particulate, stack, radon, and direct radiation monitoring will continue as planned during the third quarter of 2000.

4.1 RADIOLOGICAL AIR PARTICULATE MONITORING

4.1.1 TOTAL URANIUM, TOTAL PARTICULATE AND THORIUM

The average second quarter 2000 airborne uranium particulate concentrations were equal to or greater than the average first quarter 2000 concentrations at 14 of the 16 fenceline air particulate monitoring locations. Total uranium particulate samples are analyzed biweekly in order to track changes in fenceline uranium concentrations due to emissions remediation projects. The general increase in second quarter averages reflects the resumption of earthmoving remediation projects during the spring and early summer months. With the onset of warmer weather and the resumption of earthmoving remediation projects, biweekly airborne uranium particulate concentrations increased at several fenceline monitoring locations at the end of the second quarter, particularly along the eastern fenceline.

Figure 4-2 identifies the location of the air monitoring stations. Table 4-1 provides a summary of second quarter 2000, year-to-date, and historical total uranium concentrations. Second quarter and historical total uranium concentration graphs for each location can be viewed by going to Table 4-1 and selecting the appropriate location. Table 4-2 provides a summary of second quarter, year-to-date, and historical total particulate concentrations. Second quarter and historical total particulate concentration graphs for each location can be viewed by going to Table 4-2 and selecting the appropriate location. As indicated by the graphs, total particulate concentrations at the fenceline locations during the second quarter of 2000 are higher than first quarter 2000 total particulate concentrations. The increase in total particulate concentrations reflects the increase in particulate associated with the start of farming and the resumption of most earthmoving remediation projects.

The waste pit monitors (refer to Figure 4-2 for WPTH-1 and WPTH-2 locations) were installed to address potential increases in airborne thorium concentrations, specifically thorium-230, that may result from fugitive emissions from the excavation of the waste pits. Second quarter thorium-230 concentrations measured at WPTH-1 and WPTH-2 (refer to Figure 4-21 and Figure 4-22, respectively) reflect the continuing excavation of Waste Pit 3 and the associated material handling operations associated with WPRAP. Early in the second quarter, there was an upward trend in the thorium-230 concentrations measured at the WPTH-1 location and to a lesser extent at WPTH-2 (refer to Figure 4-22). These trends were short-lived and thorium-230 concentrations returned to more typical levels half way through the second quarter. These temporary increases were attributed to fugitive emissions from handling the waste material, while the subsequent decrease was most likely due to the implementation of additional dust controls (i.e., increased water misting for fugitive dust within the material handling building and installation of wind shields and shrouds on material handling equipment). Thorium concentrations at WPTH-1 and WPTH-2 will continue to be monitored biweekly in order to assess the impact of emissions resulting from excavation of the waste pits and material handling associated with WPRAP dryer operations. As a result of elevated thorium-230 concentrations, WPRAP will continue to operate in an effort to reduce the fugitive emissions from the excavation, transport, and handling of the waste pit materials.

Figure 4-23 and Figure 4-24 show historical concentration versus time plots of thorium-228 and thorium-232 at WPTH-1 and WPTH-2, respectively. As indicated by the plots, the airborne concentrations of thorium-228 and thorium-232 at the monitors are comparable to background and have generally remained consistent throughout the second quarter. These fenceline data reflect the fact that the concentrations of thorium-228 and thorium-232 in the waste pit material are relatively low in comparison to concentrations of thorium-230, which is in the uranium-238 decay chain. WPRAP operations are not expected to significantly impact the fenceline concentrations of thorium-228 and thorium-232.

4.1.2 NESHAP COMPLIANCE

The maximum second quarter 2000 dose equivalent, calculated from second quarter air composite data, was 0.38 millirem (mrem) and occurred at AMS-3. The maximum second quarter 2000 dose represents a notable increase over the second quarter 1999 dose of 0.11 mrem. The increase reflects the continuation of WPRAP activities during the second quarter of 2000. WPRAP remediation activities were not conducted during the first and second quarters of 1999. Table 4-3 contains the second quarter doses for each air monitoring station and the fractional contribution of each radionuclide to the total dose. The doses at the WPTH-1 and WPTH-2 monitors, which were installed to address potential increases in airborne thorium concentrations that may result from WPRAP fugitive emissions, are not reported in Table 4-3. However, it should be noted that the thorium concentrations and dose at the WPTH-1 monitor are comparable to the thorium dose measured at AMS-28 and the thorium concentrations and dose at the WPTH-2 monitors are comparable to the thorium dose measured at AMS-27.

The maximum year-to-date dose equivalent, calculated from the sum of two quarterly air composites, was 0.75 mrem which occurred at AMS-3. This maximum year-to-date fenceline dose represents 7.5 percent of the 10 mrem NESHAP Subpart H standard. Table 4-4 contains the year-to-date doses for each air monitoring station and the fractional contribution of each radionuclide to the total dose. On average, isotopes of thorium contributed approximately 57 percent of the year-to-date dose at the fenceline air monitoring stations. In particular, thorium-230 contributed 48 percent of the dose at the fenceline air monitoring stations. On average, uranium and radium-226 contributed approximately 19 percent and 23 percent, respectively, of the doses at the fenceline air monitoring stations. These relative contributions to the fenceline dose equivalent are notably different than historical dose contribution data, which indicate uranium typically contributes greater than 62 percent of the dose based on an evaluation of fenceline monitoring results from 1990 to 1998. The increase in the percentage of dose from thorium, specifically thorium-230, is attributed to emissions from the excavations and subsequent material handling associated with WPRAP.

As a result of elevated thorium-230 concentrations, WPRAP has modified its operations and facilities in an effort to reduce the fugitive emissions from the excavation, transport, and handling of the waste pit materials. Additionally, as a result of the increase in percentage of dose from thorium and in accordance with the data evaluation process described in the IEMP, isotopic thorium analysis will be performed on each biweekly IEMP air particulate sample from all 16 stations around the site perimeter. Biweekly total uranium analysis will continue at all 16 fenceline stations and the quarterly composite analysis schedule will remain the same. The addition of biweekly isotopic thorium analyses will provide more timely data for monitoring fenceline thorium levels and trending dose from airborne emissions.

The second quarter composite analysis from AMS-16, one of the background air monitoring stations, (refer to Figure 4-2) indicated elevated uranium and thorium results. The cause of the unusually high results at the background

location has not been determined. For the purposes of calculating a fenceline dose from FEMP emissions, the AMS-16 results were not considered representative of the historical background concentrations. Therefore, the results from AMS-16 were not utilized to correct fenceline air concentrations for average background air concentrations. The results from AMS-12, the other background monitor, were used to correct fenceline air concentrations for background air concentrations.

NESHAP STACK EMISSIONS MONITORING

Table 4-5 includes the NESHAP stack emissions monitoring results and Figure 4-25 shows the NESHAP stack emissions monitoring locations. Second quarter 2000 results for the Building 71 stack are within expected ranges. Typically, post production (1991 to present) stack monitoring results are near or below the minimum detectable concentration (MDC) levels for all isotopes monitored. The laundry stack monitoring was discontinued on February 2, 2000, due to suspension of laundry operations. The laundry stack monitor did not operate during the second quarter 2000, and as a result. No other significant changes in the source operations associated with either stack were noted during the second quarter.

The WPRAP dryer stack began operations late in the fourth quarter of 1999. Second quarter 2000 results also indicate levels near or below MDC levels for all isotopes, excluding radon. The WPRAP dryer stack contains a continuous radon (i.e., radon-220 and radon-222) monitor. During dryer operations, the maximum daily release of radon (radon-220 and radon-222) from the dryer stack was 531 µCi, which is below the estimated maximum hourly release rate of 13,000 µCi/hr for radon-222. Although radon stack monitoring is not required per the NESHAP Subpart H regulations, Table 4-5 includes a summary of the results from the stack radon monitor.

4.2 RADON MONITORING

4.2.1 ENVIRONMENTAL RADON

Table 4-6 summarizes second quarter 2000 and historical environmental radon data from continuous monitors. Second quarter 2000 average radon concentrations at all boundary locations (refer to Figure 4-26) were below the 3 picoCuries per liter (pCi/L) above background annual average radon concentration limit.

As expected, the highest continuous environmental radon monitoring results were recorded at the K-65 exclusion fence. Prior to re-sealing the silo domes, there had been a gradual increase in radon levels recorded at the K-65 exclusion fence corresponding to increasing radon concentrations within the two K-65 Silos. Following the re-sealing of the silo domes (completed on June 4, 1999), radon data from the K-65 Silo area has been closely monitored in order to gauge the effectiveness in reducing radon emissions. In general, second quarter 2000 radon levels at the four K-65 exclusion fence monitors are lower than during the same monthly periods in 1999. Comparing the second quarter 1999 and second quarter 2000 average radon concentrations at the four exclusion fence monitors provides some measure of the effectiveness of the re-sealing activities. The second quarter 2000 combined average radon concentration for the four K-65 exclusion fence monitors was approximately 49 percent lower than the second quarter 1999 average, suggesting the re-sealing effort contributed to a substantial reduction in radon concentrations at the K-65 Silo area.

During the second quarter of 2000, there were five exceedances of the U.S. Department of Energy Order 5400.5 100 pCi/L radon limit. For comparison, there were 12 exceedances of the 100 pCi/L radon limit during the second quarter of 1999. The reduction in the number of exceedances during the second quarter 2000 provides additional evidence that the re-sealing effort reduced radon emissions from the silos. Table 4-7 lists the exceedance event with its duration in hours, affected monitoring locations, and the maximum hourly concentration.

4.2.2 SILO HEADSPACE

K-65 Silo headspace radon concentrations fluctuate seasonally due to changes in meteorological parameters (e.g., temperature, barometric pressure, humidity, etc.). To account for the seasonal variations, concentrations are summarized quarterly (from the daily average concentrations) in order to compare data collected under similar meteorological conditions. Table 4-8 presents average headspace radon concentrations by month, utilizing data from the continuous monitoring system. Monthly average radon concentrations for K-65 Silo 1 during the second quarter of 2000 ranged between 16.3 and 18.1 million pCi/L. The quarterly average concentration increased approximately 31 percent over the quarterly average concentration during the same period in 1999. The average concentration for Silo 1 is approximately 65 percent of the pre-bentonite concentration level (~26 million pCi/L). Second quarter 2000 monthly average continuous monitoring results for K-65 Silo 2 ranged between 15.0 and 15.2 million pCi/L. The quarterly average concentration increased approximately 81 percent from the average concentration during the same period in 1999. The average concentration for Silo 2 is approximately 50 percent of the pre-bentonite concentration level (~30 million pCi/L).

The increases in the reported silos headspace radon concentrations are due in part to the application of correction factors which are used to account for the non-equilibrium conditions encountered when calculating and reporting headspace radon concentrations using the continuous monitoring system. The development and application of these correction factors was presented in previous quarterly status reports. The increases are also the result of the gradual deterioration in the effectiveness of the bentonite seal layer with the silos which has also been previously reported and discussed.

4.3 DIRECT RADIATION (TLD) MONITORING

All monitoring results from direct radiation measurements for the second quarter of 2000 were within historical ranges. Figure 4-28 depicts the monitoring locations and direct radiation measurements are shown in Table 4-9. As noted in previous IEMP quarterly status reports, a positive trend in the immediate area of the K-65 Silos (locations 22 through 26) has been identified and will continue to be monitored (refer to Figure 4-29). This trend is attributed to a corresponding increase in radon and radon-progeny concentrations observed in the K-65 Silo headspace. The increase in direct radiation measurements adjacent to the silos is still well below the levels observed prior to the addition of bentonite to the silos in 1991.

As discussed in previous reports, a slight positive trend in direct radiation measurements at the site fenceline nearest the K-65 Silos (location 6) has been identified. The trend is associated with the increasing direct radiation levels at the K-65 Silos, as discussed above. The upward trend at the site fenceline nearest the K-65 Silos is difficult to measure consistently due to small variations in the sensitivity and accuracy of the environmental TLDs. Figure 4-30 shows the slight positive trend at location 6.

TABLE 4-1

TOTAL URANIUM PARTICULATE CONCENTRATIONS IN AIR

Location	Second Quarter 2000 Results[a] (pCi/m³ x 1E-6)				2000 Summary Results[a] (pCi/m³ x 1E-6)				1990 through 1999 Summary Results[a] (pCi/m³ x 1E-6)	
	No. of Samples	Min.	Max.	Avg.	No. of Samples	Min.	Max.	Avg.	Min.	Max.
Fenceline										
AMS-2	6	32	241	125	13	22	241	98	0	3500
AMS-3	6	84	424	181	13	34	424	166	0	17000
AMS-4	6	19	53	31	13	16	127	43	0	2300
AMS-5	6	0.0	68	34	13	0.0	68	34	0	4400
AMS-6	6	36	176	74	13	23	176	60	0	3200
AMS-7	6	22	101	42	13	7.9	101	36	0	7800
AMS-8A	6	73	841	238	13	25	841	173	0	1135
AMS-9C[b]	6	26	303	170	13	26	303	145	0	562
AMS-22	6	15	238	98	13	0.52	238	77	0	101
AMS-23	6	28	191	100	13	15	191	80	0	202
AMS-24	6	19	133	43	13	12	133	42	0	112
AMS-25	6	13	51	26	13	0.53	125	30	0	402
AMS-26	6	11	114	42	13	9.4	114	34	0	171
AMS-27	6	12	124	46	13	12	124	42	0	101
AMS-28	6	2.2	153	115	13	2.2	153	79	0	445
AMS-29	6	26	51	40	13	18	124	52	0	199
Background										
AMS-12	6	3.6	30	16	13	3.6	30	14	0	480
AMS-16	6	7.0	143	36	13	4.0	143	26	0	350

[a]For blank corrected concentrations less than or equal to 0.0 pCi/m³, the concentration is set as 0.0 pCi/m³.
[b]Summary results for 1990 through 1999 include AMS-9B/C data.

TABLE 4-2

TOTAL PARTICULATE CONCENTRATIONS IN AIR

Location	Second Quarter 2000 Results (µg/m³)				2000 Summary Results (µg/m³)				1990 through 1999 Summary Results (µg/m³)	
	No. of Samples	Min.	Max.	Avg.	No. of Samples	Min.	Max.	Avg.	Min.	Max.
Fenceline										
AMS-2	6	25	39	34	13	17	39	27	7.0	77
AMS-3	6	27	44	37	13	17	44	29	8.0	159
AMS-4	6	30	45	37	13	19	45	30	13	79
AMS-5	6	26	44	36	13	20	44	29	9.6	62
AMS-6	6	27	45	38	13	20	45	30	8.0	69
AMS-7	6	32	52	42	13	20	52	34	6.8	84
AMS-8A	6	28	45	38	13	20	67	35	13	89
AMS-9C[a]	6	29	46	37	13	19	46	30	7.1	136
AMS-22	6	28	45	36	13	21	45	32	13	57
AMS-23	6	26	45	34	13	17	45	28	15	57
AMS-24	6	5.4	47	33	13	5.4	47	29	13	79
AMS-25	6	30	47	39	13	23	47	32	17	69
AMS-26	6	26	40	33	13	20	40	27	15	52
AMS-27	6	41	72	53	13	30	72	47	16	92
AMS-28	6	25	68	37	13	16	68	28	12	51
AMS-29	6	28	45	37	13	18	45	29	11	62
Background										
AMS-12[b]	6	24	39	31	13	17	39	26	6.0	416
AMS-16[b]	6	37	52	43	13	27	52	39	18	84

[a]Summary results for 1990 through 1999 include AMS-9B/C data.
[b]Total particulate analysis was discontinued during 1994 and was reinstated for AMS-12 and AMS-16 in 1997.

TABLE 4-3

SECOND QUARTER NESHAP COMPLIANCE TRACKING

	40 CFR 61 (NESHAP) Subpart H Appendix E, Table 2; Net Ratios[a]													
Location	Ac-228[b]	Ra-224[b]	Ra-226	Ra-228[b]	Th-228	Th-230	Th-231[b]	Th-232	Th-234[b]	U-234	U-235/ U-236	U-238	Ratio Totals	Dose[c] (mrem)
Fenceline														
AMS-2	1.7E-07	4.2E-06	1.7E-03	1.1E-04	1.5E-04	4.3E-03	2.6E-09	1.0E-03	6.4E-06	1.3E-03	1.0E-04	1.7E-03	0.010	0.105
AMS-3	2.6E-07	6.3E-06	6.9E-03	1.6E-04	2.0E-04	2.4E-02	6.9E-09	1.5E-03	1.1E-05	2.4E-03	2.7E-04	3.0E-03	0.038	0.382
AMS-4	1.9E-07	4.8E-06	2.8E-03	1.2E-04	7.3E-05	5.7E-04	1.0E-09	1.2E-03	9.0E-07	1.4E-04	4.0E-05	2.4E-04	0.005	0.051
AMS-5	8.8E-08	2.2E-06	2.1E-03	5.5E-05	2.0E-04	2.4E-03	1.5E-09	5.2E-04	2.4E-06	2.6E-04	5.8E-05	6.4E-04	0.006	0.063
AMS-6	1.1E-07	2.7E-06	1.4E-03	6.7E-05	1.0E-04	4.8E-03	2.0E-09	6.4E-04	3.2E-06	4.9E-04	7.9E-05	8.4E-04	0.008	0.084
AMS-7	2.2E-07	5.5E-06	3.2E-03	1.4E-04	2.1E-04	2.4E-03	2.0E-09	1.3E-03	3.4E-06	5.9E-04	7.7E-05	9.1E-04	0.009	0.089
AMS-8A	3.3E-07	8.2E-06	2.2E-03	2.1E-04	3.1E-04	9.2E-03	6.4E-09	2.0E-03	1.7E-05	3.9E-03	2.5E-04	4.5E-03	0.023	0.225
AMS-9C	3.7E-07	9.1E-06	2.9E-03	2.3E-04	9.0E-05	8.5E-03	3.4E-09	2.2E-03	8.2E-06	1.7E-03	1.3E-04	2.2E-03	0.018	0.180
AMS-22	1.3E-07	3.1E-06	2.5E-03	8.0E-05	5.2E-06	2.7E-03	1.4E-09	7.6E-04	2.4E-06	4.6E-04	5.3E-05	6.3E-04	0.007	0.071
AMS-23	4.0E-07	9.8E-06	2.4E-03	2.5E-04	3.7E-04	2.8E-03	1.1E-09	2.4E-03	3.0E-06	5.6E-04	4.4E-05	7.9E-04	0.010	0.095
AMS-24	2.3E-07	5.7E-06	2.5E-03	1.5E-04	4.3E-05	9.7E-03	2.7E-09	1.4E-03	8.8E-06	1.1E-03	1.1E-04	2.3E-03	0.017	0.174
AMS-25	1.3E-07	3.1E-06	2.6E-03	7.9E-05	2.6E-04	3.0E-03	1.4E-09	7.5E-04	2.5E-06	3.5E-04	5.5E-05	6.7E-04	0.008	0.078
AMS-26	4.8E-08	1.2E-06	3.5E-03	3.0E-05	1.1E-04	2.3E-03	2.1E-09	2.8E-04	2.5E-06	3.7E-04	8.1E-05	6.5E-04	0.007	0.073
AMS-27	3.0E-07	7.3E-06	4.9E-03	1.9E-04	3.6E-04	3.2E-03	--	1.8E-03	3.5E-06	5.4E-04	--	9.3E-04	0.012	0.119
AMS-28	--	--	1.2E-03	--	--	9.3E-03	3.9E-09	--	1.0E-05	9.5E-04	1.5E-04	2.7E-03	0.014	0.144
AMS-29	1.2E-07	3.1E-06	2.2E-03	7.8E-05	--	2.4E-03	1.9E-09	7.5E-04	1.8E-06	3.0E-04	7.3E-05	4.8E-04	0.006	0.063
Background														
AMS-12	3.5E-07	8.6E-06	1.6E-03	2.2E-04	6.1E-04	8.0E-04	--	2.1E-03	1.0E-06	2.7E-04	--	2.8E-04	NA[e]	
AMS-16[d]	--	--	--	--	--	--	--	--	--	--	--	--	NA[e]	
QA/QC														
Column Check[f]	0.000	0.001	0.450	0.019	0.025	0.914	0.000	0.184	0.001	0.154	0.016	0.232	NA[e]	2.00

Maximum Quarterly Ratio: 0.038
Maximum Quarterly Dose (mrem): 0.38

[a]A "-" indicates the filter results were less than or equal to the blank results, and/or the indicator concentrations were less than or equal to the average net background concentrations.
[b]Isotopes assumed to be in equilibrium with their parents.
[c]Dose conversions are based on the NESHAP standard of 10 mrem per year.
[d]AMS-16 background sample results were rejected because not representative of historical background levels.
[e]NA = not applicable
[f]Column check is the sum of doses from each radionuclide, followed by the sum of doses (2.00) at all fenceline monitors.

TABLE 4-4

YEAR-TO-DATE NESHAP COMPLIANCE TRACKING

	40 CFR 61 (NESHAP) Subpart H Appendix E, Table 2; Net Ratios[a]													
Location	Ac-228[b]	Ra-224[b]	Ra-226	Ra-228[b]	Th-228	Th-230	Th-231[b]	Th-232	Th-234[b]	U-234	U-235/ U-236	U-238	Ratio Totals	Dose[c] (mrem)
Fenceline														
AMS-2	1.7E-07	4.2E-06	1.7E-03	1.1E-04	1.5E-04	7.1E-03	3.9E-09	1.0E-03	9.7E-06	1.9E-03	1.5E-04	2.6E-03	0.015	0.147
AMS-3	8.3E-07	2.1E-05	1.2E-02	5.2E-04	6.2E-04	4.7E-02	1.0E-08	5.0E-03	2.1E-05	4.3E-03	4.1E-04	5.7E-03	0.075	0.752
AMS-4	2.5E-07	6.1E-06	2.8E-03	1.6E-04	7.3E-05	5.3E-03	2.6E-09	1.5E-03	3.7E-06	6.8E-04	1.0E-04	9.9E-04	0.012	0.116
AMS-5	1.3E-07	3.2E-06	2.7E-03	8.1E-05	2.0E-04	6.0E-03	1.8E-09	7.7E-04	4.1E-06	5.3E-04	7.03-05	1.1E-03	0.011	0.114
AMS-6	2.2E-07	5.4E-06	1.4E-03	1.4E-04	1.0E-04	8.4E-03	2.5E-09	1.3E-03	5.7E-06	9.7E-04	9.6E-05	1.5E-03	0.014	0.140
AMS-7	2.2E-07	5.5E-06	3.8E-03	1.4E-04	2.1E-04	3.2E-03	2.5E-09	1.3E-03	4.4E-06	7.4E-04	9.7E-05	1.2E-03	0.011	0.107
AMS-8A	4.5E-07	1.1E-05	2.2E-03	2.8E-04	3.1E-04	1.7E-02	7.8E-09	2.7E-03	2.2E-05	4.9E-03	3.0E-04	6.0E-03	0.034	0.337
AMS-9C	8.0E-07	2.0E-05	6.4E-03	5.0E-04	9.0E-05	2.1E-02	5.8E-09	4.8E-03	1.5E-05	3.1E-03	2.3E-04	4.1E-03	0.040	0.400
AMS-22	1.3E-07	3.1E-06	2.5E-03	8.0E-05	5.2E-06	5.9E-03	1.4E-09	7.6E-04	5.8E-06	9.0E-04	5.3E-05	1.5E-03	0.012	0.117
AMS-23	4.4E-07	1.1E-05	6.0E-03	2.7E-04	3.7E-04	7.4E-03	2.5E-09	2.6E-03	6.2E-06	1.1E-03	9.9E-05	1.6E-03	0.020	0.195
AMS-24	2.3E-07	5.7E-06	2.8E-03	1.5E-04	4.3E-05	1.4E-02	3.0E-09	1.4E-03	1.1E-05	1.5E-03	1.2E-04	2.8E-03	0.023	0.226
AMS-25	2.5E-07	6.3E-06	8.3E-03	1.6E-04	2.7E-04	7.1E-03	1.4E-09	1.5E-03	4.2E-06	6.8E-04	5.5E-05	1.1E-03	0.019	0.192
AMS-26	4.8E-08	1.2E-06	3.5E-03	3.0E-05	1.1E-04	4.6E-03	2.4E-09	2.8E-04	3.6E-06	6.0E-04	9.3E-05	9.5E-04	0.010	0.102
AMS-27	3.0E-07	7.3E-06	8.4E-03	1.9E-04	3.6E-04	5.4E-03	--	1.8E-03	4.8E-06	7.3E-04	--	1.3E-03	0.018	0.181
AMS-28	--	--	1.2E-03	--	--	1.2E-02	3.9E-09	--	1.3E-05	1.2E-03	1.5E-04	3.4E-03	0.018	0.180
AMS-29	3.1E-07	7.6E-06	6.2E-03	1.9E-04	1.2E-04	8.8E-03	3.7E-09	1.8E-03	6.4E-06	1.3E-03	1.5E-04	1.7E-03	0.020	0.202
Background														
AMS-12	5.3E-07	1.3E-05	1.0E-02	3.3E-04	1.1E-03	1.1E-03	6.2E-10	3.2E-03	1.7E-06	4.8E-04	2.4E-05	4.6E-04	NA[e]	
AMS-16[d]	5.0E-07	1.2E-05	8.1E-03	3.1E-04	9.6E-04	8.0E-04	--	3.0E-03	1.0E-06	2.8E-04	--	2.6E-04	NA[e]	
QA/QC														
Column Check[f]	0.000	0.001	0.715	0.030	0.030	1.798	0.000	0.285	0.001	0.251	0.022	0.374	NA[e]	3.51

Maximum Year-To-Date Ratio: 0.0752
Maximum Year-To-Date Dose (mrem): 0.752

[a] A "-" indicates the filter results were less than or equal to the blank results, and/or the indicator concentrations were less than or equal to the average net background concentrations.
[b] Isotopes assumed to be in equilibrium with their parents.
[c] Dose conversions are based on the NESHAP standard of 10 mrem per year.
[d] AMS-16 background sample results were rejected because not representative of historical background levels.
[e] NA = not applicable
[f] Column check is the sum of doses from each radionuclide, followed by the sum of doses (3.51) at all fenceline monitors.

TABLE 4-5

NESHAP STACK EMISSION MONITORING RESULTS

Analysis Performed	Second Quarter 2000 Results		2000 Summary Results		1999 Summary Results	
	No. of Samples[a,b]	Total Pounds[a,c]	No. of Samples[a]	Total Pounds[a,c]	No. of Samples[a]	Total Pounds[a,c]
Building 71 Stack						
Uranium, Total	1	3.1E-06	2	3.1E-06	5	2.6E-05
Thorium-232	1	6.1E-06	2	1.5E-05	5	5.2E-05
Thorium-230	1	1.1E-10	2	2.7E-10	5	1.0E-09
Total Particulate	NR	NR	1	0.0E+00	3[d]	5.8E-01
Laundry Stack						
Uranium, Total	NA	NA	2	1.4E-05	9[e]	2.6E-05
Thorium-232	NA	NA	2	7.5E-05	9[e]	5.8E-04
Thorium-230	NA	NA	2	9.0E-10	9[e]	6.9E-09
Total Particulate	NA	NA	2	7.0E-02	7[d,e]	6.0E-01
WPRAP Dryer Stack						
Uranium-238	3	2.5E-05	6	2.8E-05[f]	1	ND
Uranium-235/236	3	9.6E-08	6	9.6E-08	1	ND
Uranium-234	3	1.3E-09	6	1.5E-09[f]	1	ND
Thorium-232	3	3.4E-07	6	3.5E-07	1	ND
Thorium-230	3	3.1E-10	6	4.3E-10[f]	1	ND
Thorium-228	3	ND	6	3.9E-16[f]	1	ND
Radium-226[g]	3	ND	6	3.2E-11[f]	1	ND
Total Particulate	NS	NS	NS	NS	NS	NS

Analysis Performed	Second Quarter 2000 Results		
	Average Daily Release Rate (μCi)[h]	Maximum Daily Release Rate (μCi)[h]	Estimated Maximum Hourly Release Rate for Radon-222 (μCi/hr)
WPRAP Dryer Stack			
Radon-220/222	40	531	13,000

[a]ND = non-detectable
NA = not applicable
NS = not sampled
NR = no report of analysis from laboratory
[b]WPRAP dryer stack sample consisted of six composited filters over three sampling periods.
[c]Total pounds are only determined from detected results.
[d]Some particulate result(s) could not be determined due to a damaged filter(s).
[e]Includes previously unreported results from a second quarter 1999 sample
[f]2000 summary results for WPRAP dryer stack include revised first quarter results.
[g]Radium-226 is not required to be analyzed in WPRAP dryer stack samples, but is provided for informational purposes.
[h]Reflects daily release rate information during period of operation from April through June

TABLE 4-6

**CONTINUOUS ENVIRONMENTAL RADON MONITORING
MONTHLY AVERAGE CONCENTRATIONS[a]**

	Second Quarter 2000 Monthly Results[b] (Instrument Background Corrected) (pCi/L)			2000 Summary Results[b] (Instrument Background Corrected) (pCi/L)			1999 Summary Results[b] (Instrument Background Corrected) (pCi/L)		
Location	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
Fenceline									
AMS-02	0.2	0.3	0.3	0.2	0.4	0.3	0.2	1.0	0.5
AMS-03	0.4	0.6	0.5	0.3	0.6	0.4	0.1	1.0	0.5
AMS-04	0.2	0.2	0.2	0.2	0.4	0.2	0.1	0.8	0.4
AMS-05	0.3	0.3	0.3	0.2	0.5	0.3	0.2	1.4	0.7
AMS-06	0.2	0.2	0.2	0.2	0.4	0.2	0.2	0.8	0.5
AMS-07	0.3	0.4	0.3	0.3	0.5	0.4	0.3	1.5	0.8
AMS-08A[c]	0.3	0.5	0.4	0.3	0.5	0.4	0.1	0.8	0.4
AMS-09C	0.1	0.3	0.2	0.1	0.3	0.2	0.2	0.8	0.5
AMS-22	0.1	0.2	0.2	0.1	0.5	0.2	0.1	0.5	0.3
AMS-23	0.1	0.2	0.1	0.1	0.3	0.2	0.1	0.6	0.3
AMS-24[c]	0.2	0.3	0.3	0.2	0.4	0.3	0.2	1.1	0.6
AMS-25[c]	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.8	0.5
AMS-26	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.8	0.5
AMS-27	0.2	0.3	0.3	0.2	0.3	0.3	0.2	1.1	0.6
AMS-28[c]	0.2	0.2	0.2	0.2	0.4	0.3	0.1	0.8	0.4
AMS-29[c]	0.3	0.3	0.3	0.3	0.7	0.4	0.1	0.8	0.4
Background									
AMS-12	0.1	0.2	0.1	0.1	0.2	0.1	0.1	0.5	0.2
AMS-16	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.5	0.3
On Site									
KNE	1.9	2.4	2.0	1.9	2.5	2.1	1.7	18.3	9.6
KNW	1.4	4.2	2.7	1.4	4.2	2.6	2.1	8.2	3.8
KSE	3.2	4.6	3.7	1.3	4.6	2.7	1.2	9.9	4.9
KSW	1.7	2.4	2.0	1.2	2.4	1.7	1.7	4.8	3.1
KTOP	2.5	3.7	3.0	2.5	4.0	3.5	3.4	15.8	8.4
Pilot Plant Warehouse	0.1	0.3	0.2	0.1	0.3	0.2	0.3	0.8	0.4
Rally Point 4	0.3	0.3	0.3	0.3	0.4	0.3	0.5	1.3	0.8
Surge Lagoon	0.3	0.3	0.3	0.2	0.3	0.3	0.4	1.0	0.7
T28	1.0	1.2	1.1	0.8	1.2	1.1	1.1	3.8	2.2
TS4[d]	0.1	0.2	0.2	0.1	0.2	0.2	0.2	0.9	0.5
WP-17A	0.2	0.3	0.3	0.2	0.4	0.3	0.1	1.1	0.6

[a]Monthly average radon concentrations are calculated from daily average concentrations. Daily average concentrations are calculated by summing all hourly count data, treating the sum as a single daily measurement, and then converting the sum to a (daily average) concentration.
[b]Instrument background changes as monitors are replaced
[c]Unit was placed in service in December 1998.
[d]Unit was placed in service in January 1999.

TABLE 4-7

2000 SECOND QUARTER RADON CONCENTRATIONS
100 pCi/L EXCEEDANCES AT THE K-65 SILOS 1 AND 2 EXCLUSION FENCE

Exceedance Event Start Date	Duration of Exceedance (hours)	Maximum Recorded Hourly Radon Concentration (pCi/L)	Monitoring Location(s)
4/16	3	165	KNW
4/27	1	114	KSE
5/1	1	140	KNW
5/5	1	130	KNW
6/12	3	219	KSE

TABLE 4-8

RADON HEADSPACE CONCENTRATIONS

	Radon Headspace Concentrations[a,b,c] (pCi/L)											
	Silo 1 2000			Silo 1 1999			Silo 2 2000			Silo 2 1999		
Month	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.
January	1.71E+07	2.09E+07	1.81E+07	1.24E+07	1.44E+07	1.34E+07	1.44E+07	1.98E+07	1.66E+07	8.78E+06	1.11E+07	9.95E+06
February	1.58E+07	1.76E+07	1.69E+07	1.27E+07	1.35E+07	1.32E+07	1.50E+07	1.96E+07	1.75E+07	8.70E+06	9.68E+06	9.20E+06
March	1.56E+07	1.73E+07	1.64E+07	1.25E+07	1.33E+07	1.29E+07	1.45E+07	1.66E+07	1.56E+07	8.66E+06	9.89E+06	9.30E+06
April	1.59E+07	1.69E+07	1.63E+07	1.22E+07	1.30E+07	1.25E+07	1.43E+07	1.60E+07	1.51E+07	7.74E+06	8.53E+06	8.10E+06
May	1.56E+07	1.99E+07	1.81E+07	1.21E+07	1.32E+07	1.26E+07	1.39E+07	1.57E+07	1.50E+07	7.77E+06	8.73E+06	8.21E+06
June	1.61E+07	2.04E+07	1.75E+07	1.25E+07	1.36E+07	1.30E+07	1.47E+07	1.61E+07	1.52E+07	8.04E+06	9.08E+06	8.50E+06

[a]Minimum equals minimum recorded daily average radon concentration.
[b]Maximum equal maximum recorded daily average radon concentration.
[c]Average equals monthly average of recorded daily radon concentrations.

TABLE 4-9

DIRECT RADIATION (TLD) MEASUREMENTS

	Direct Radiation (mrem)			
Location	First Quarter 2000 Results	Second Quarter 2000 Results	2000 Summary Results[a]	1999 Summary Results
Fenceline				
2	18	18	35	75
3	17	17	33	72
4	16	16	32	68
5	15	16	32	70
6	19	19	38	81
7	15	16	31	68
8A	16	17	33	74
9C	17	19	36	76
13	17	17	33	74
14	17	17	33	71
15	18	20	38	79
16	18	20	38	81
17	17	17	33	70[b]
34	17	17	34	76
35	16	16	32	71
36	15	15	30	64
37	18	19	36	76
38	14	15	29	63
39	18	19	37	79
40	15	15	31	68
41	17	18	35	72
Min.	**14**	**15**	**29**	**63**
Max.	**19**	**20**	**38**	**81**
On Site				
22	283	244	527	904
23A[c]	241	235	477	866[d]
24	219	171	390	707
25	205	223	427	881
26	137	144	280	547
32	13	13	27	55
Min.	**13**	**13**	**27**	**55**
Max.	**283**	**244**	**527**	**904**
Background				
18	18	17	35	77
19	15	14	29	63
20	15	14	29	62
27	14	15	29	62
33	16	17	33	67
Min.	**14**	**14**	**29**	**62**
Max.	**18**	**17**	**35**	**77**

[a]2000 summary result value may not always agree with quarterly results due to rounding differences.
[b]Direct radiation value includes estimated second quarter results which were based on first quarter results.
[c]TLD location 23 was relocated to TLD location 23A on May 26, 1999.
[d]Direct radiation levels for TLD locations 23 and 23A were extrapolated.

FIGURE 4-1

AIR SAMPLING ACTIVITIES

SAMPLING ACTIVITIES	Quarter/Year											
	First Quarter/2000			Second Quarter/2000			Third Quarter/2000			Fourth Quarter/2000		
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Radiological Particulate Monitoring:				◆	◆	◆	☒	☒	☒			
NESHAP Quarterly Composite						◆			☒			
NESHAP Stack Emissions Monitoring				◆	◆	◆	☒	☒	☒			
Radon Monitoring – Continuous Alpha Scintillation Monitors				◆	◆	◆	☒	☒	☒			
Direct Radiation (TLD) Monitoring						◆			☒			

◆ Data summarized/evaluated in this report
☒ Data summarized/evaluated in the next report

FINAL

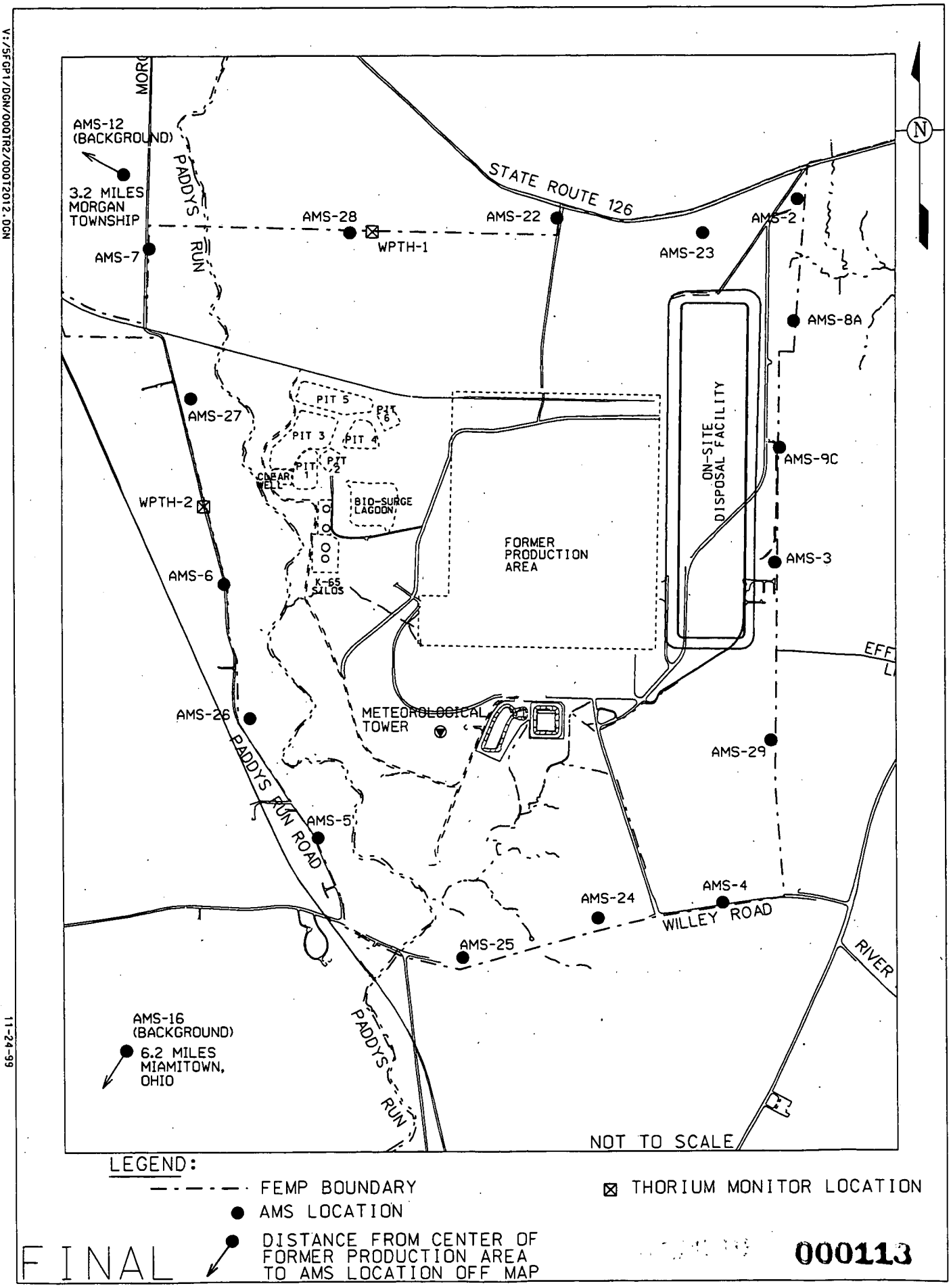


FIGURE 4-2. IEMP AIR MONITORING LOCATIONS

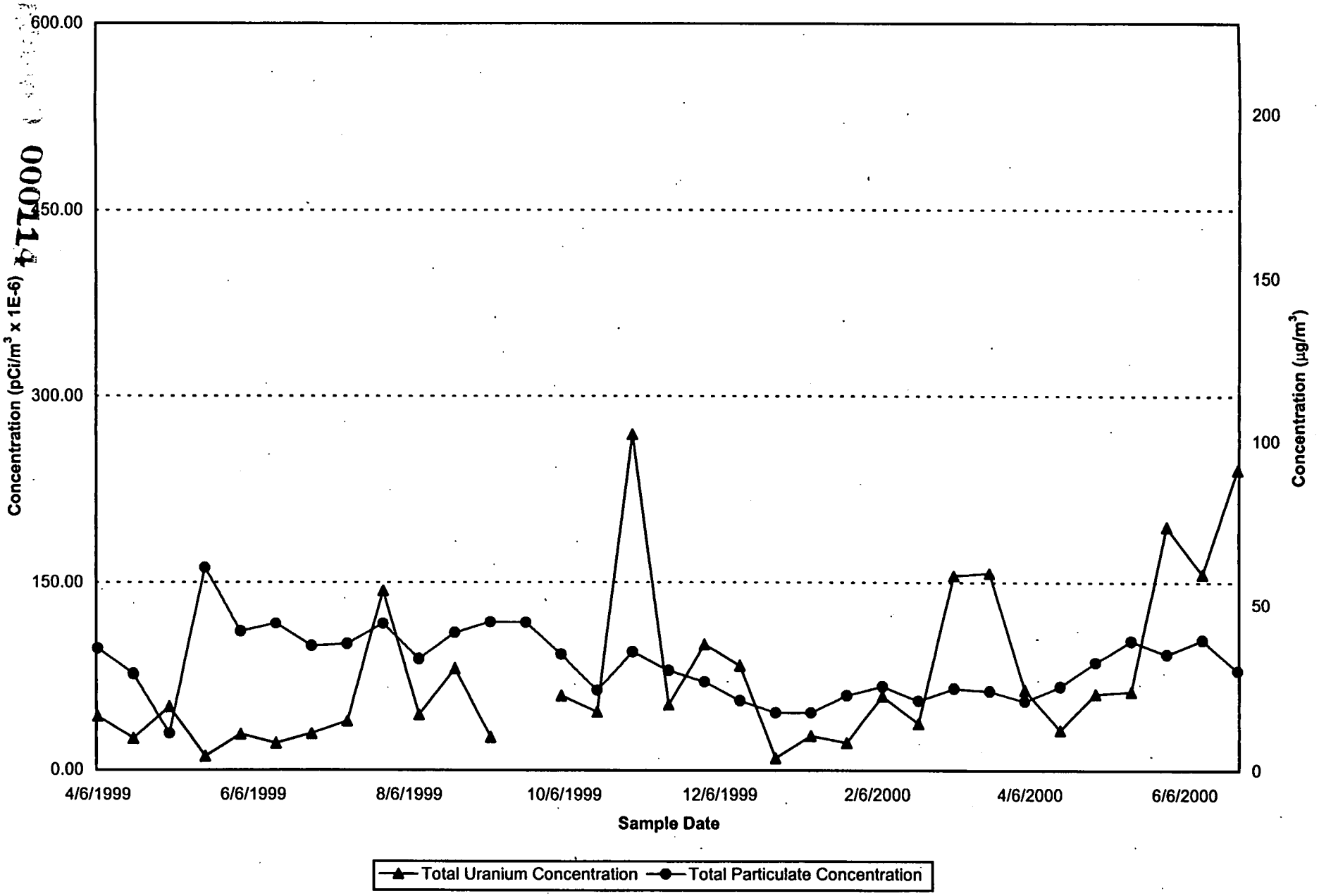


FIGURE 4-3. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-2)

FINAL

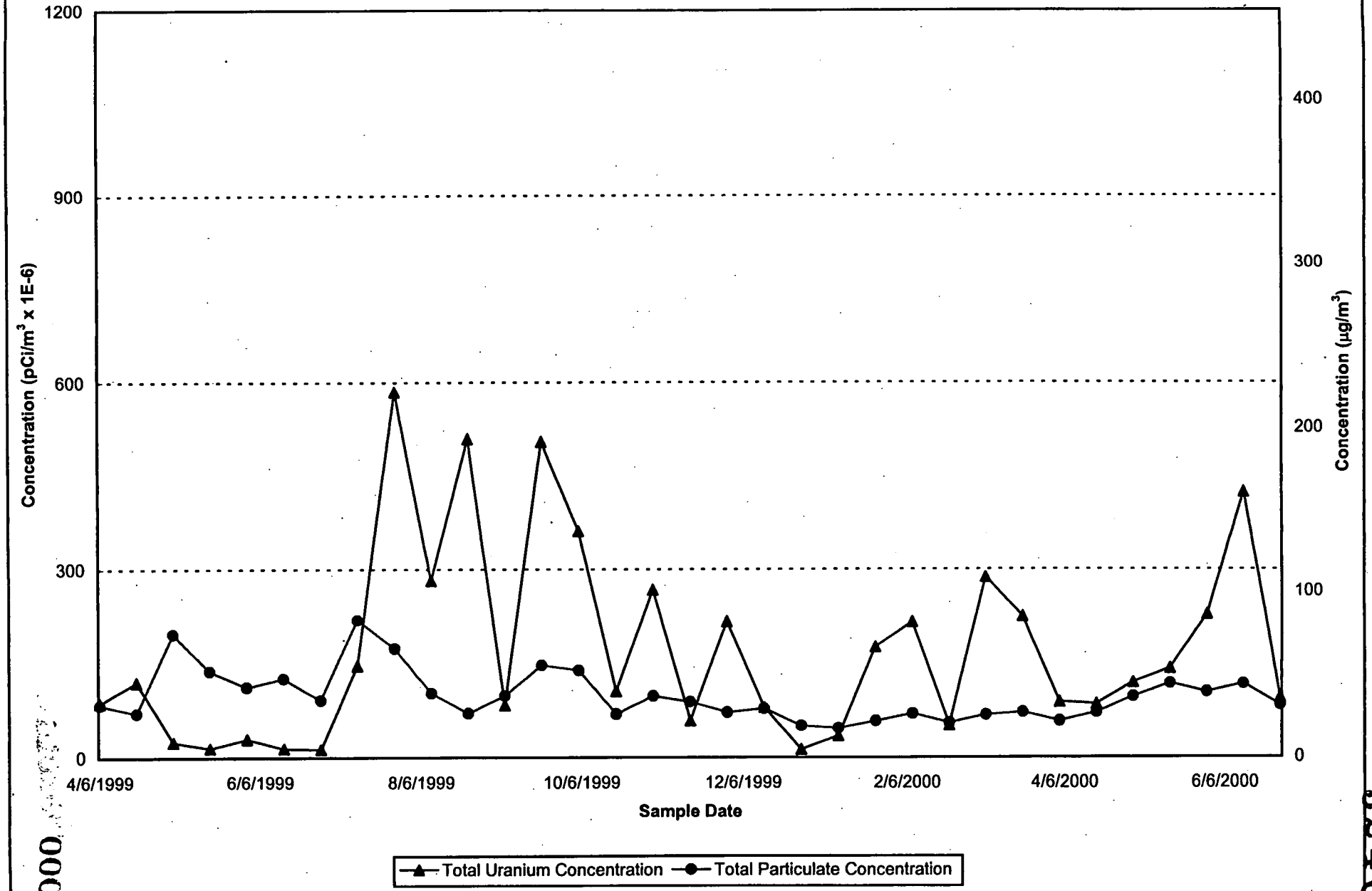


FIGURE 4-4. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-3)

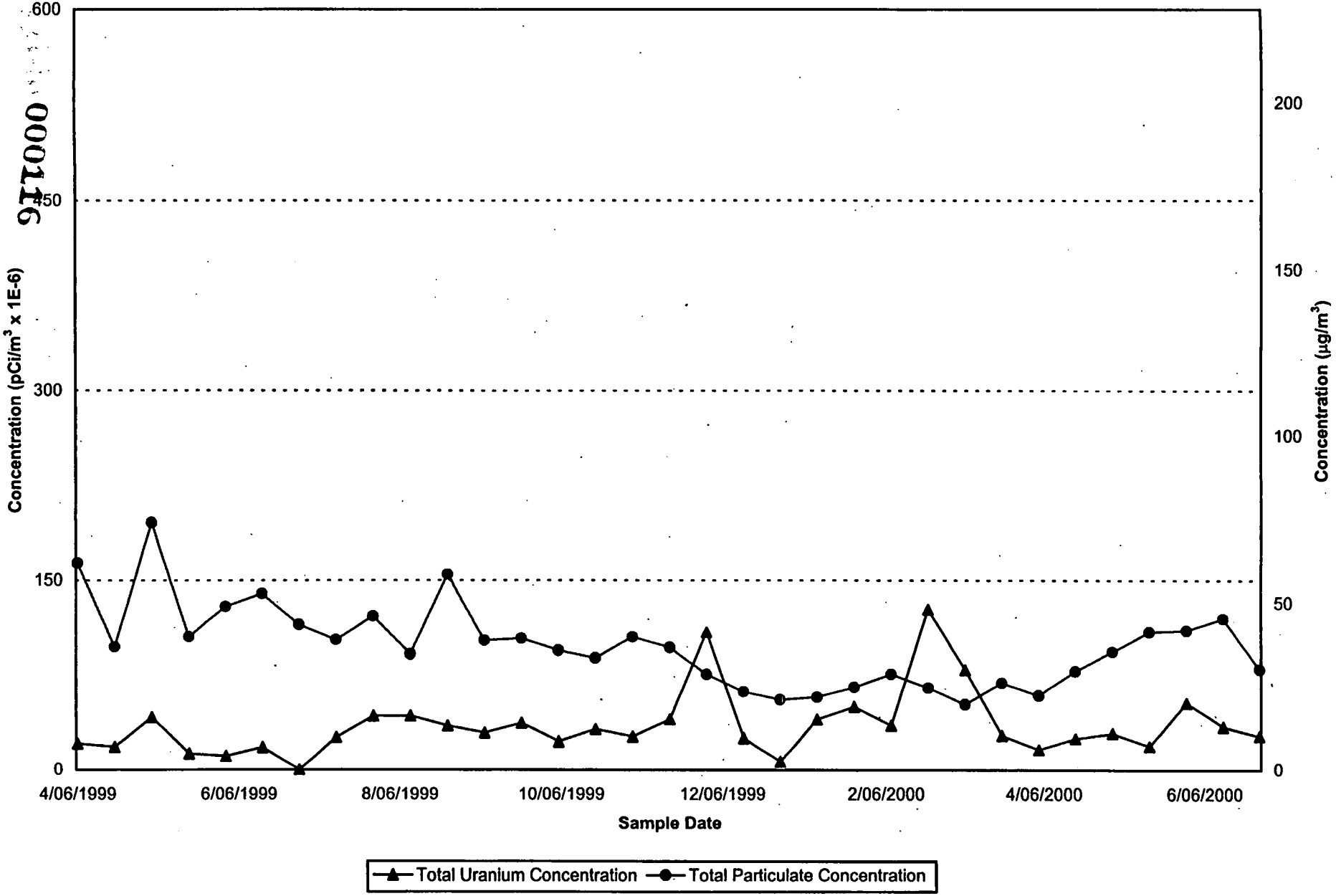


FIGURE 4-5. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-4)

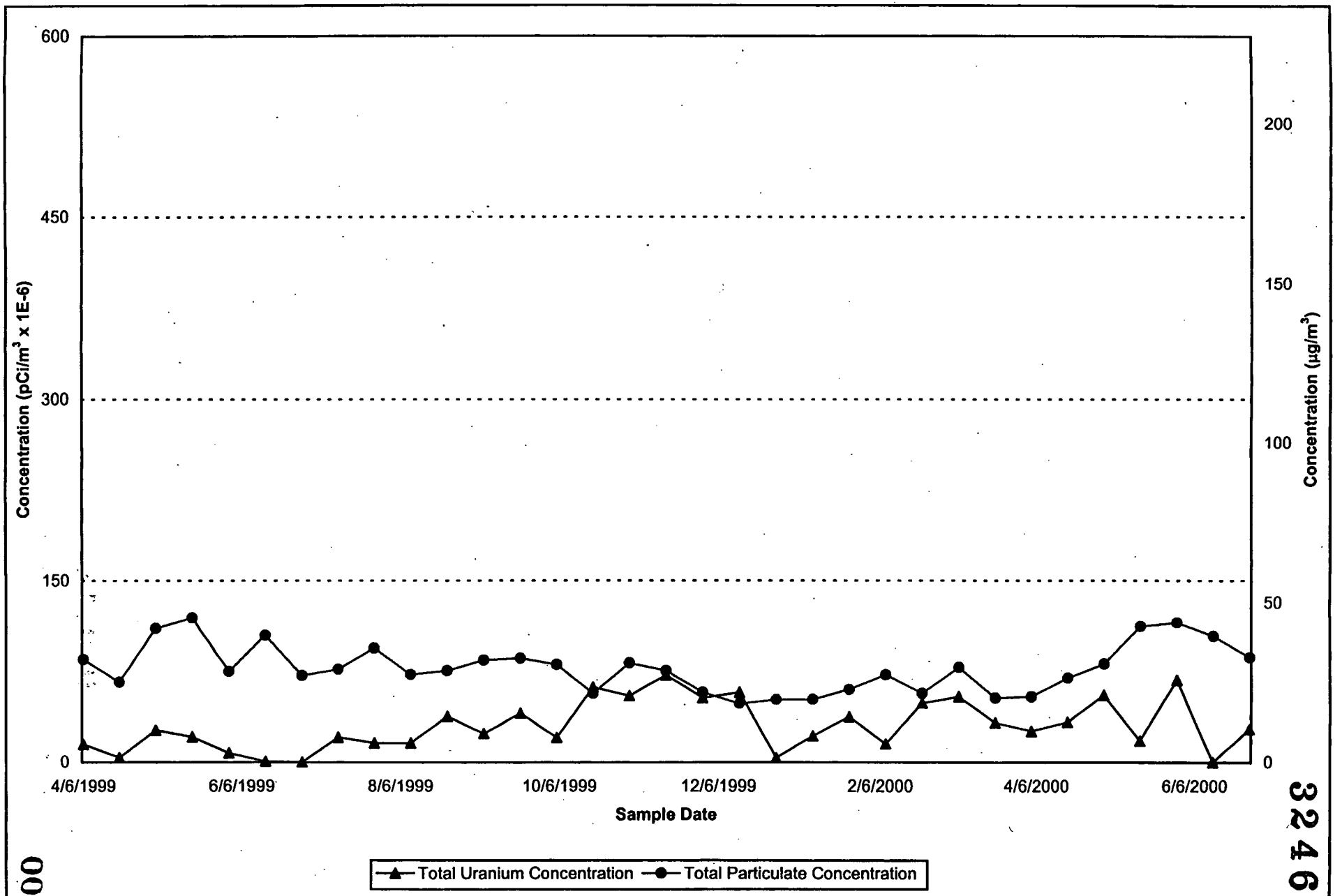


FIGURE 4-6. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-5)

FINAL

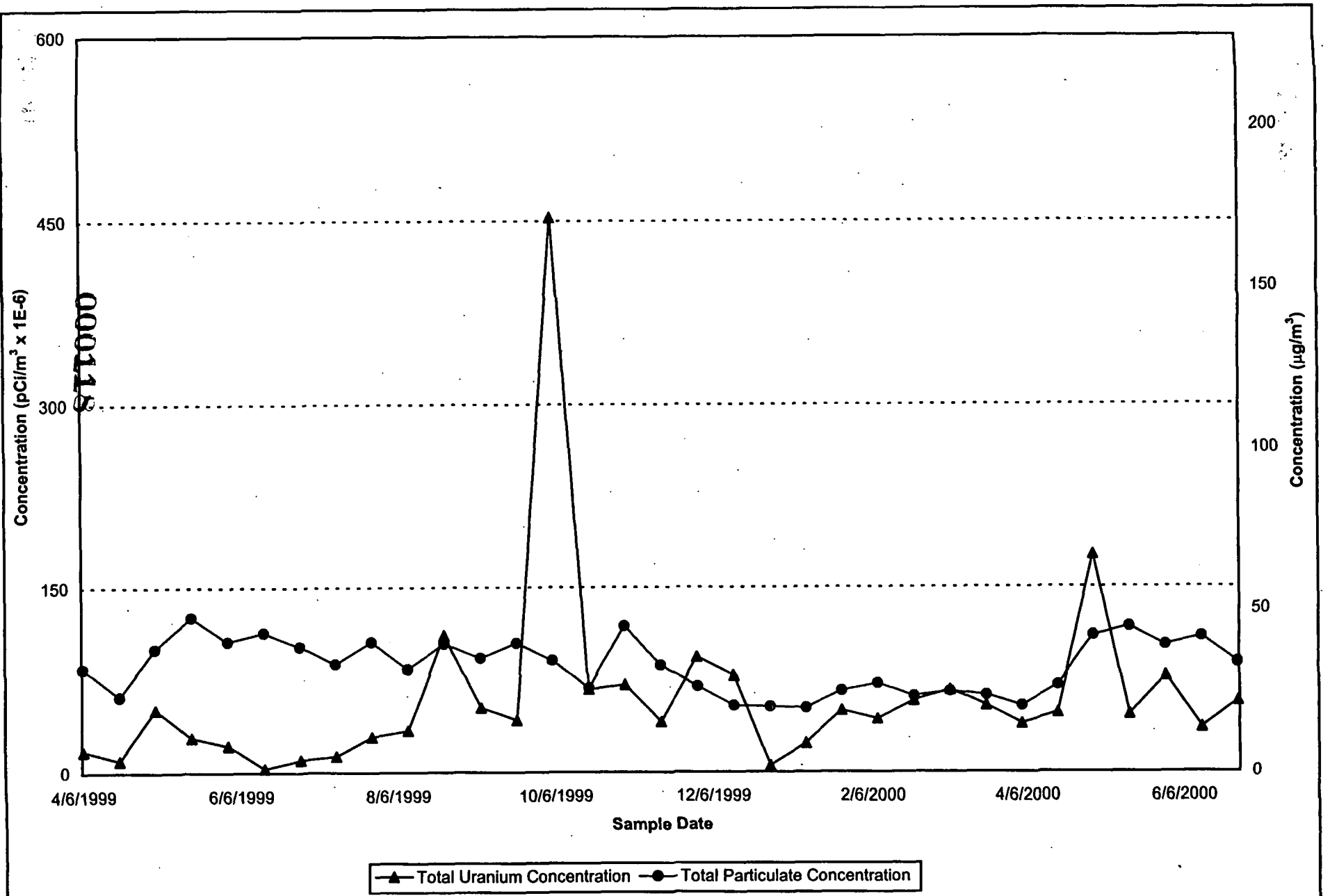


FIGURE 4-7. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-6)

FINAL

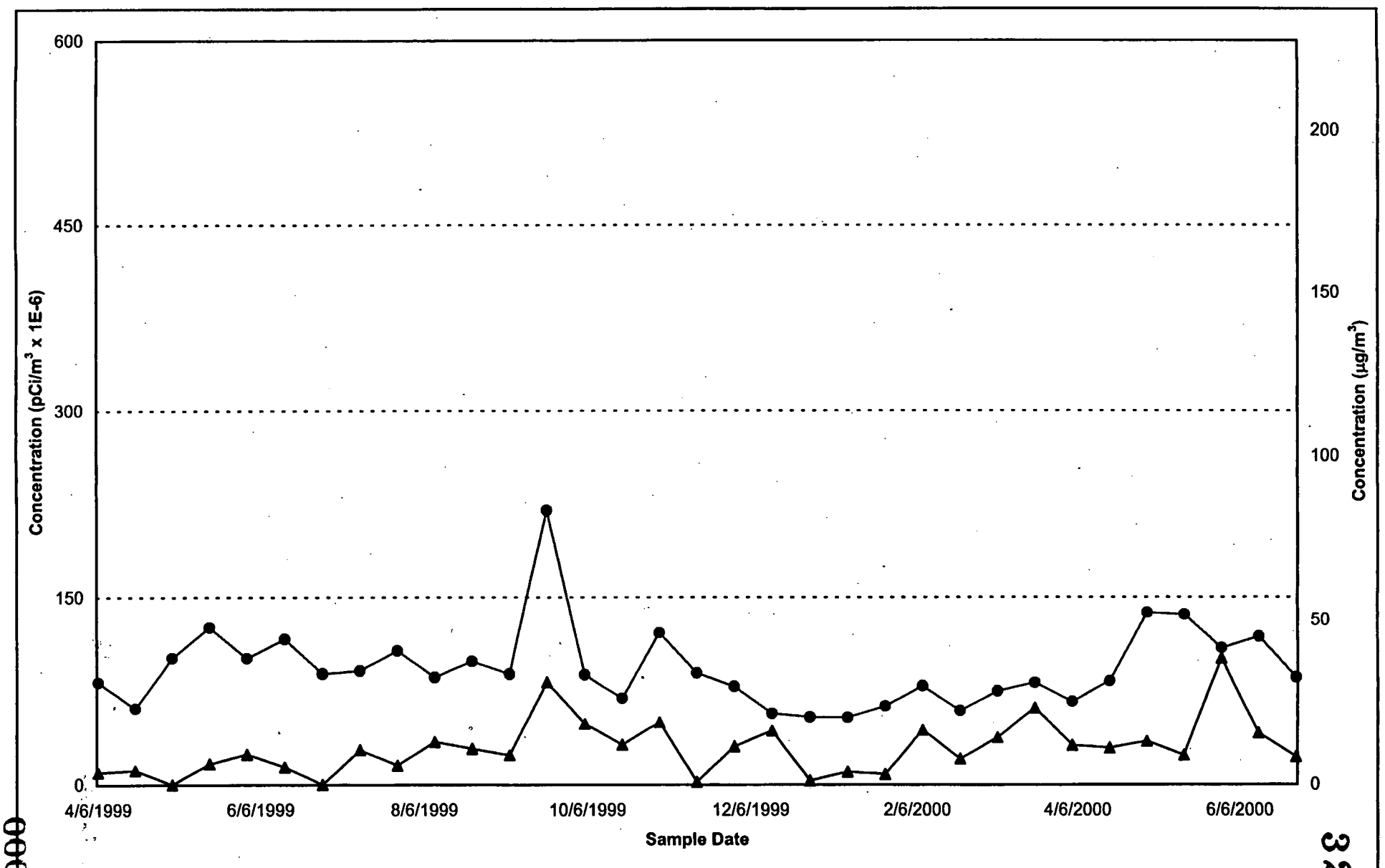


FIGURE 4-8. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-7)

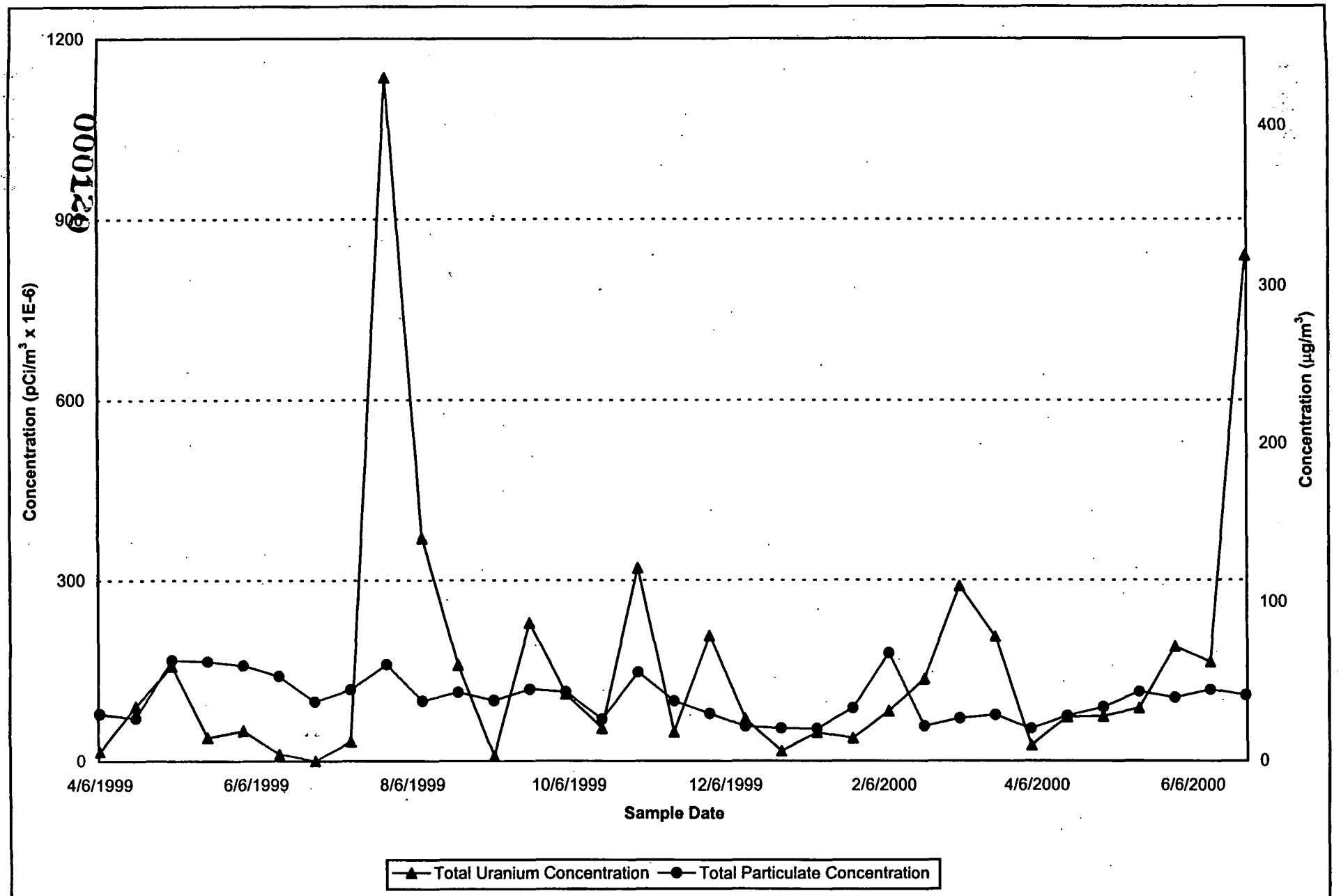


FIGURE 4-9. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-8A)

FINAL

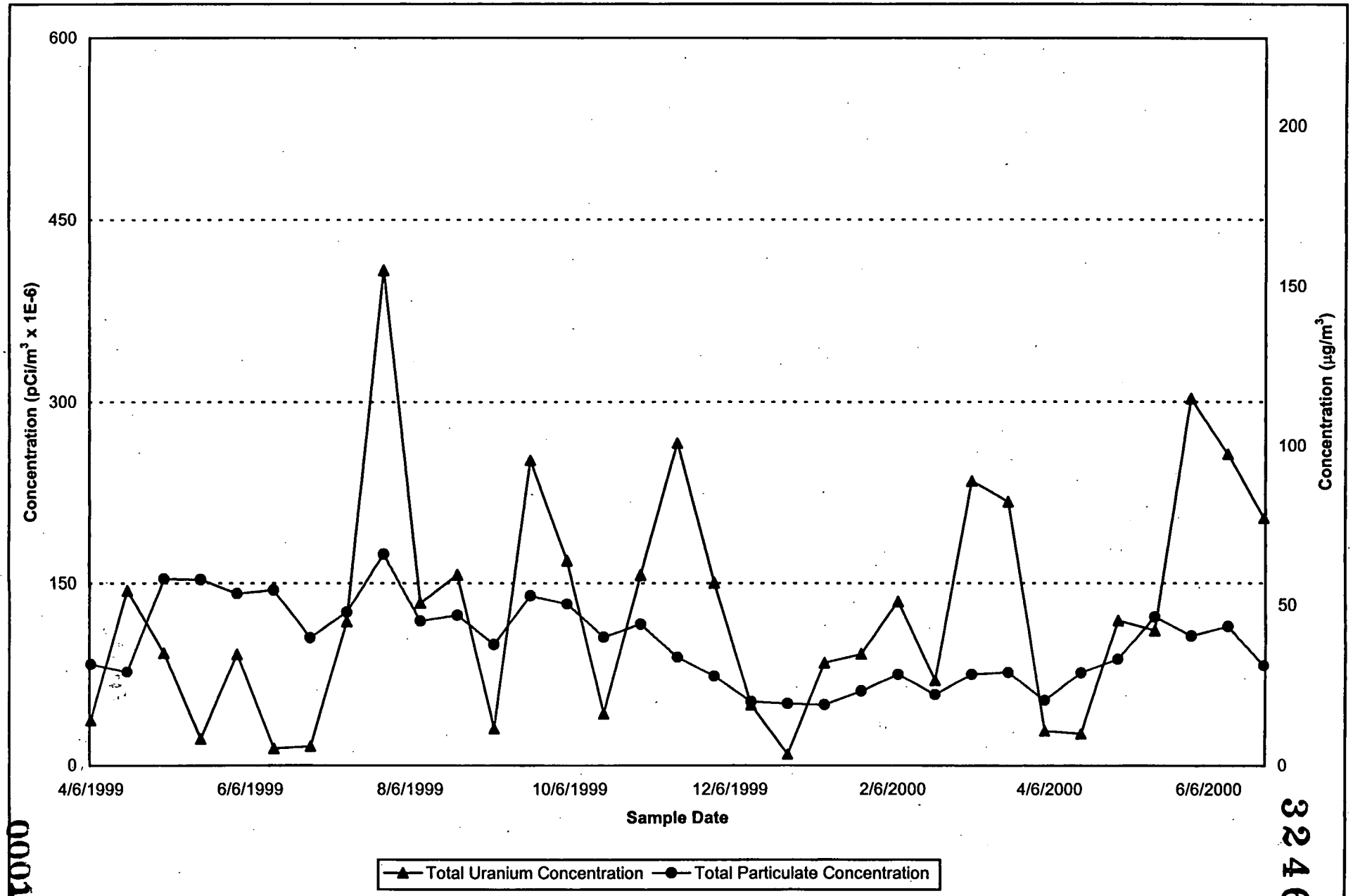


FIGURE 4-10. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-9C)

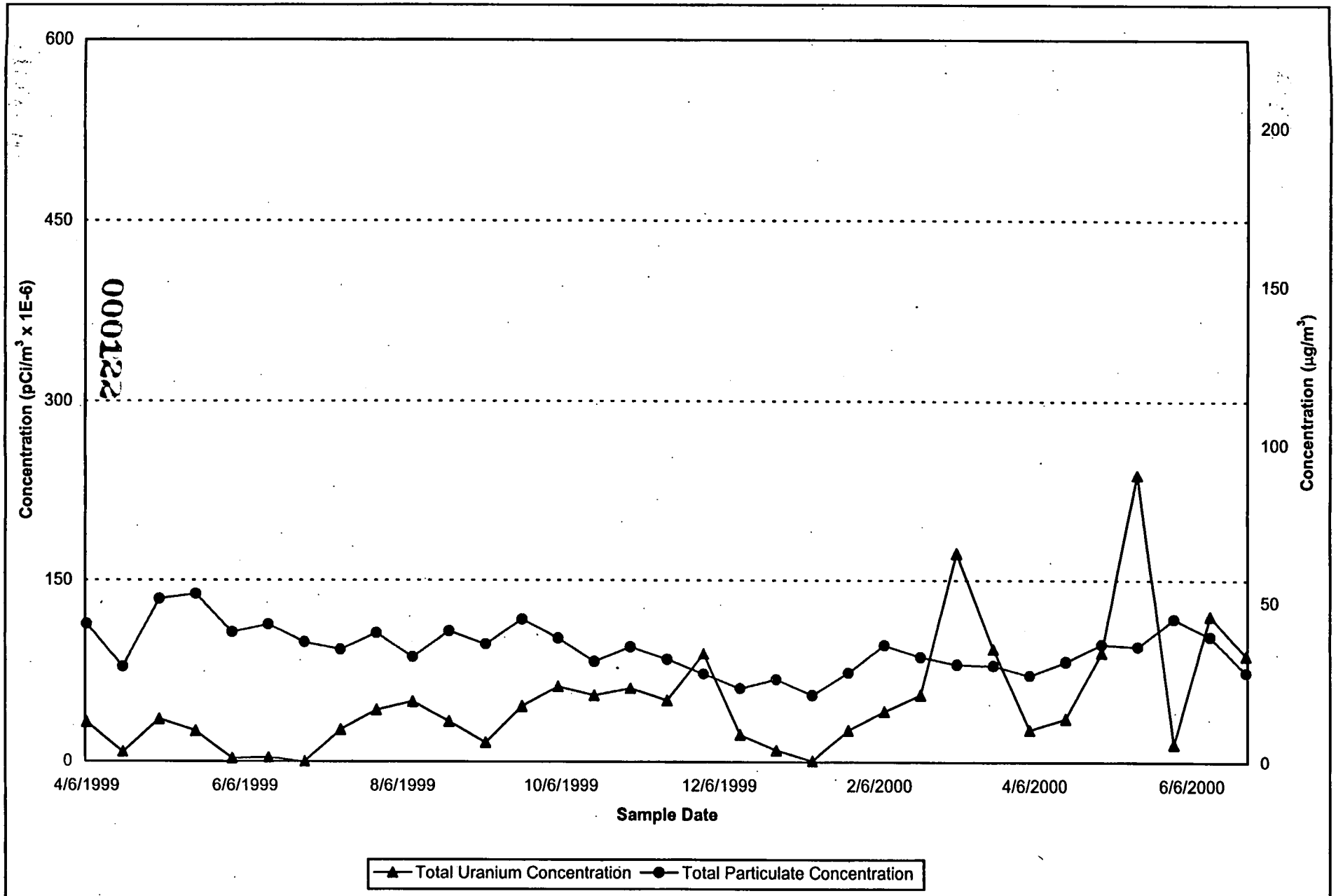


FIGURE 4-11. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-22)

FINAL

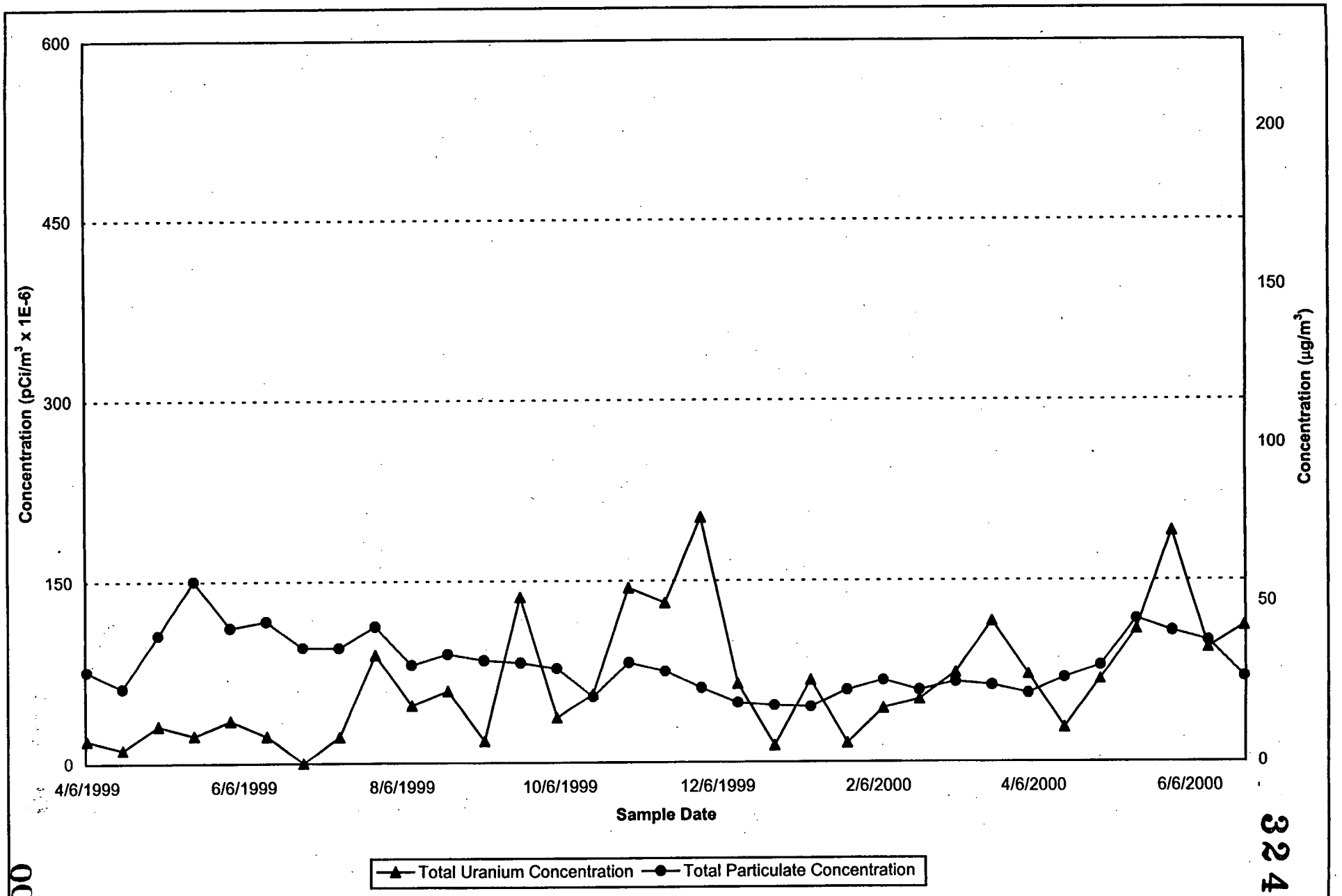


FIGURE 4-12. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-23)

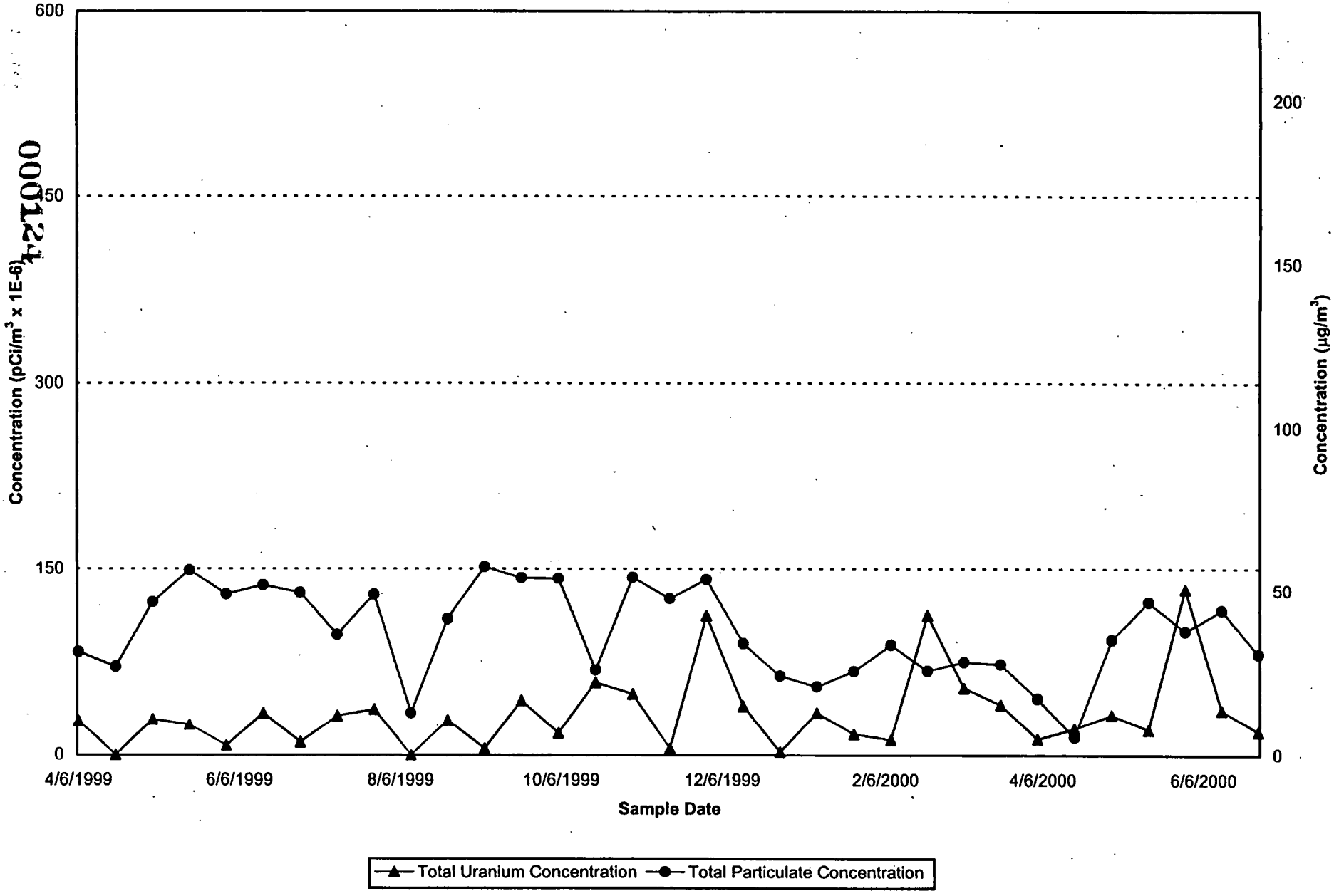


FIGURE 4-13. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-24)

FINAL

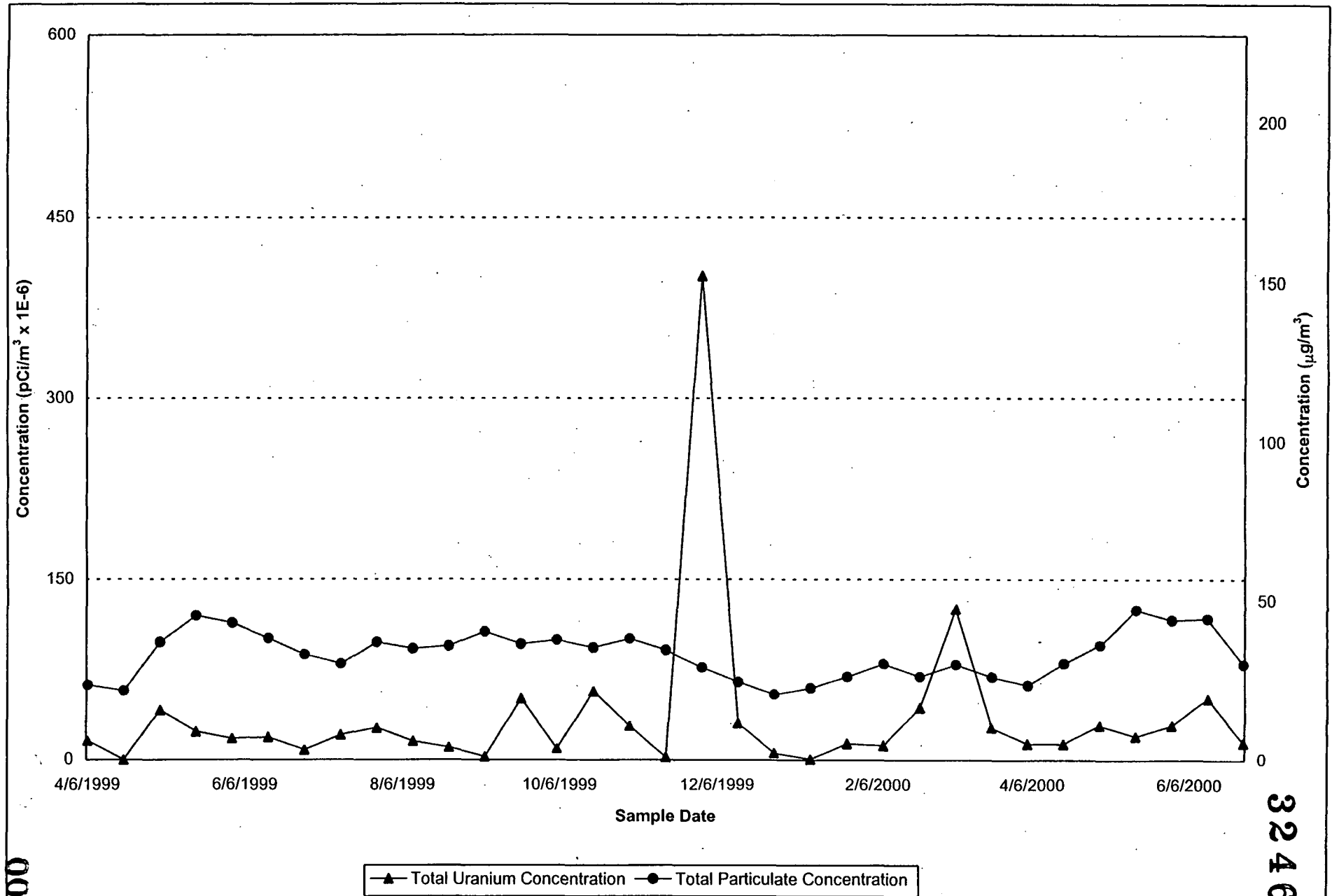


FIGURE 4-14. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-25)

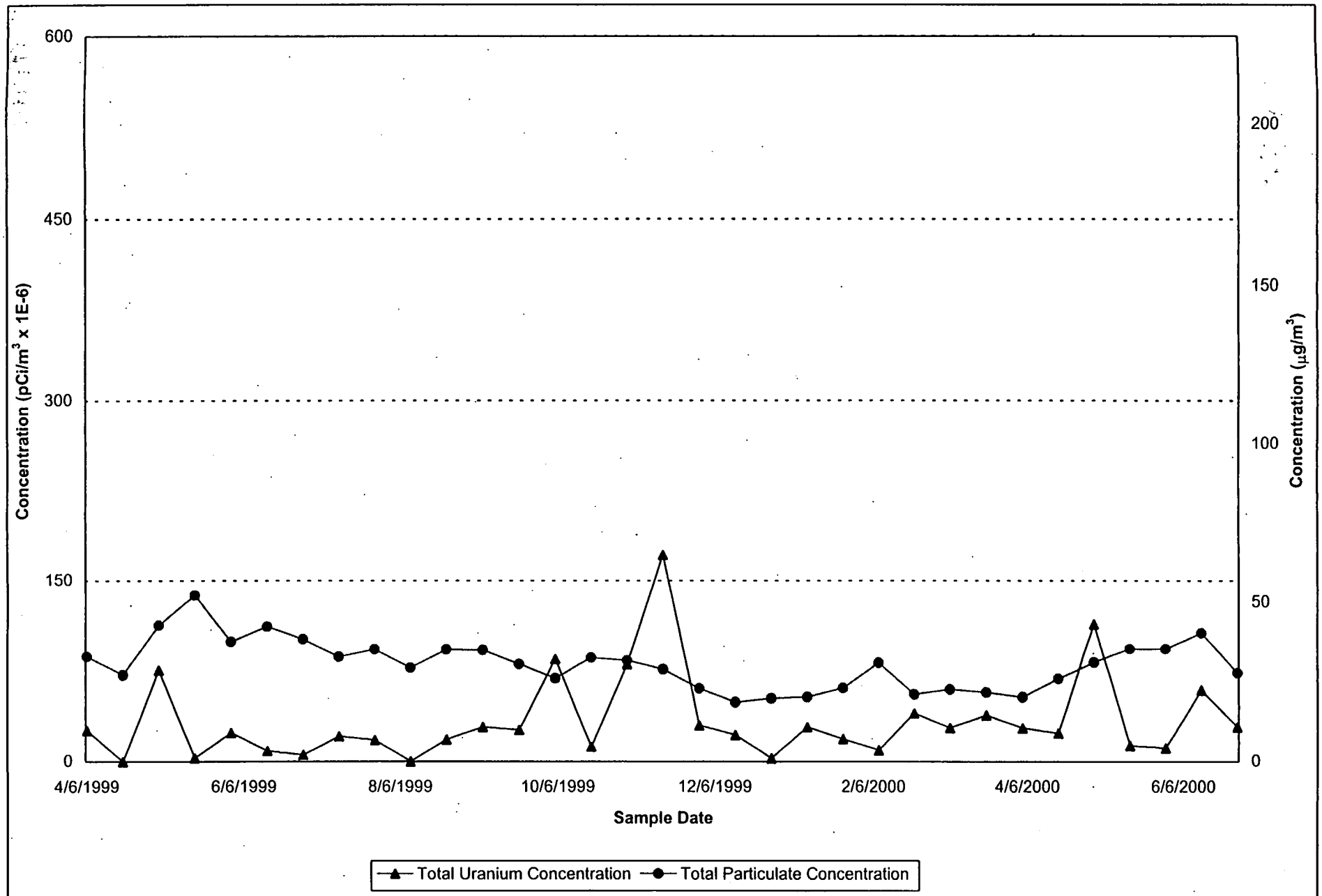


FIGURE 4-15. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-26)

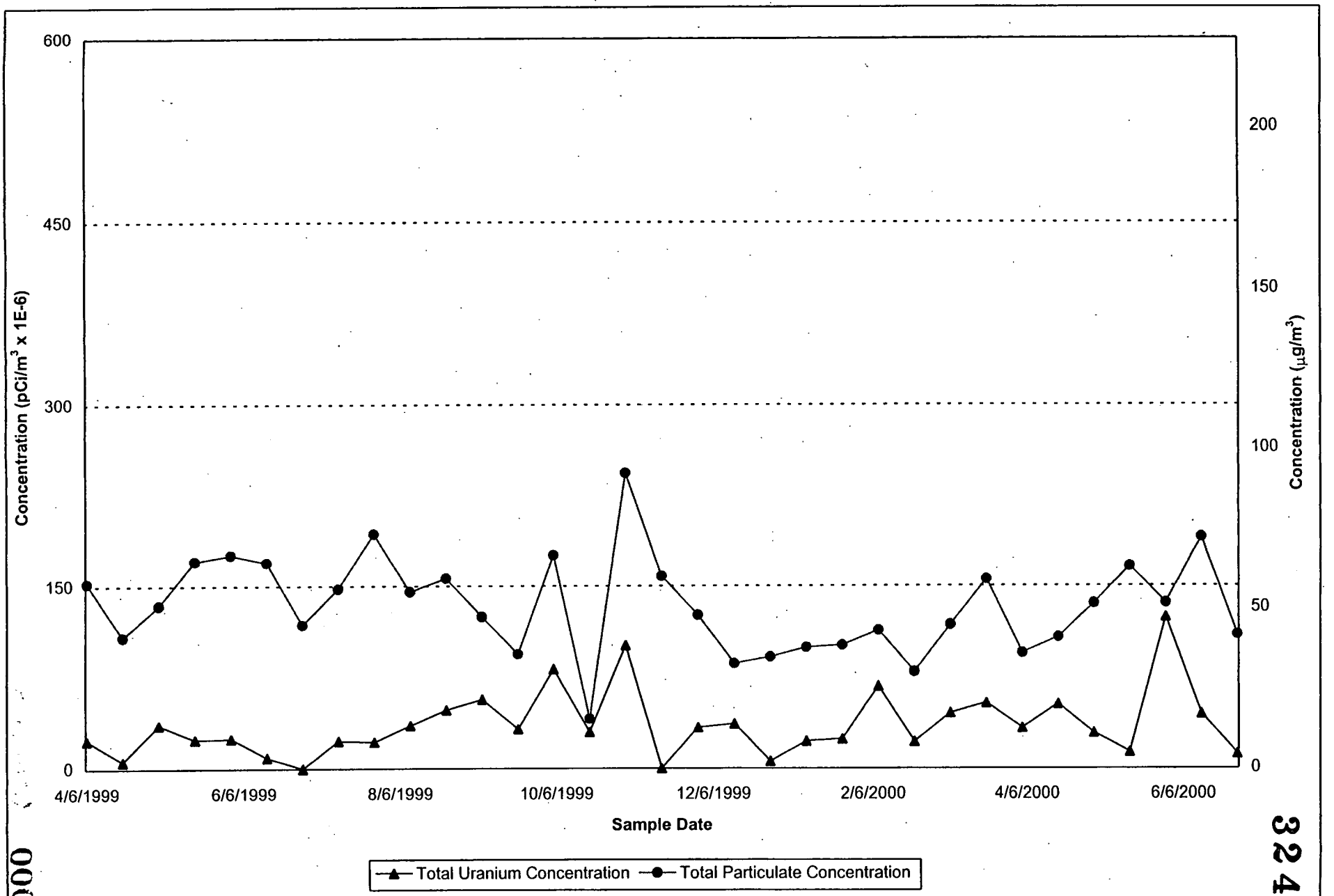


FIGURE 4-16. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-27)

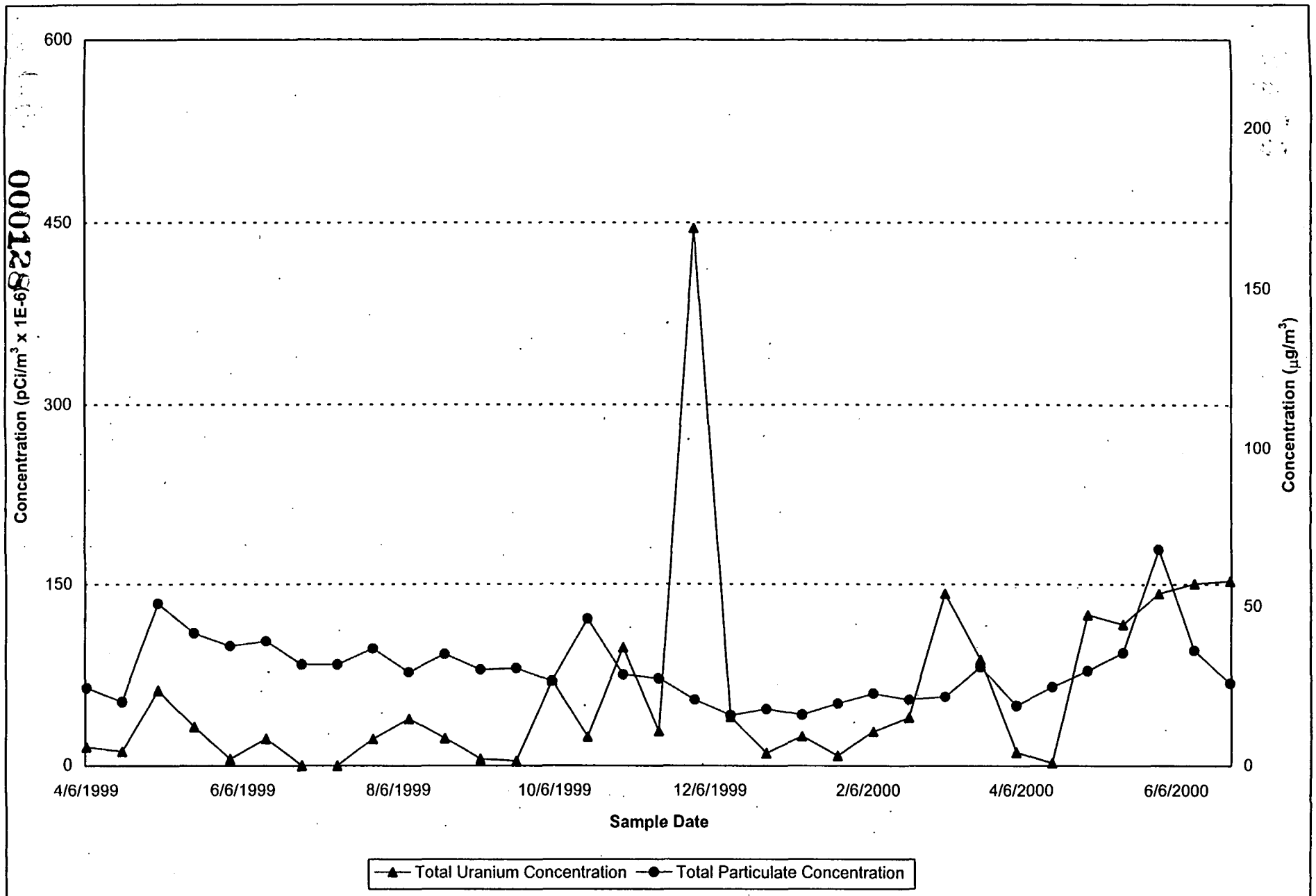


FIGURE 4-17. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-28)

FINAL

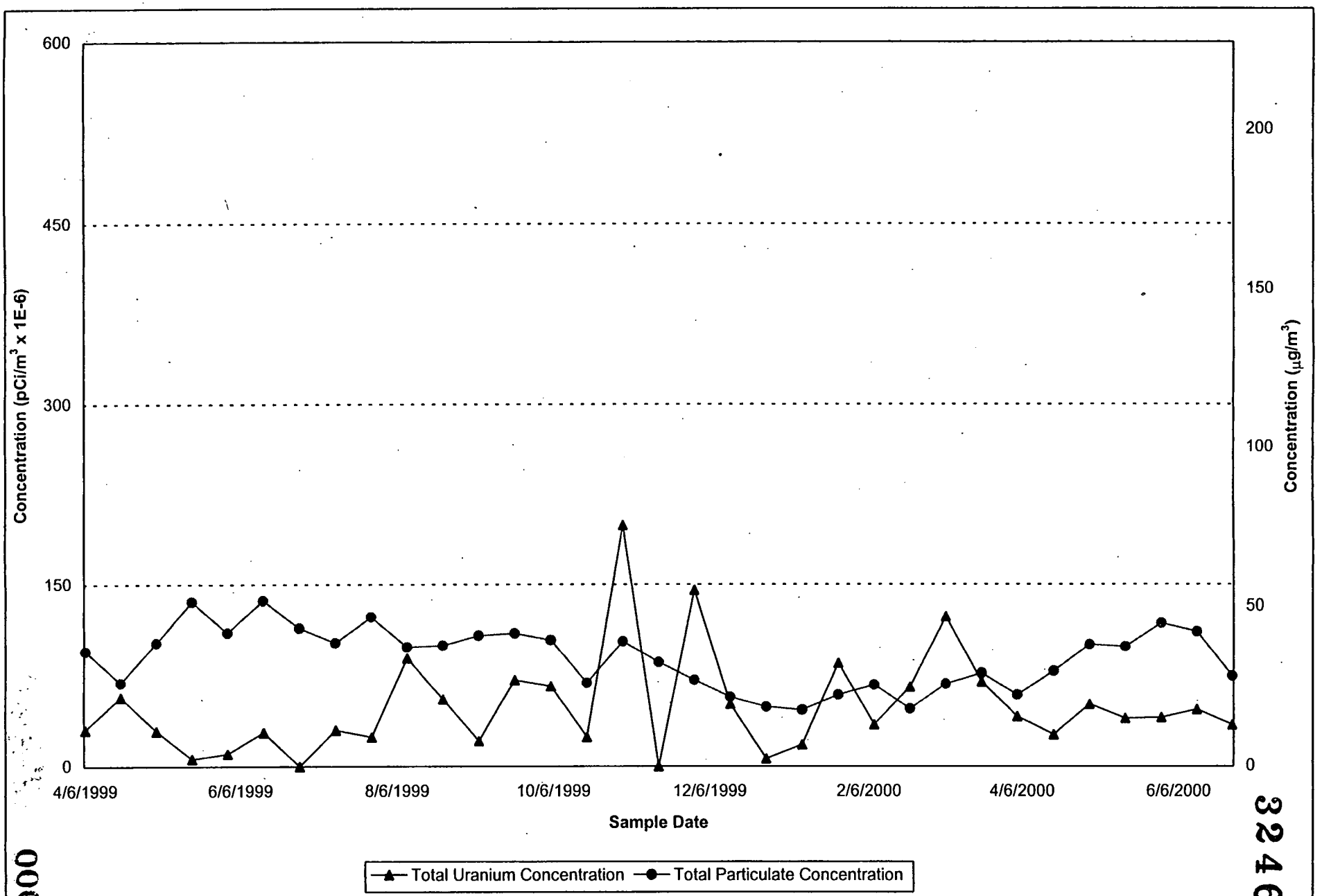


FIGURE 4-18. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-29)

FINAL

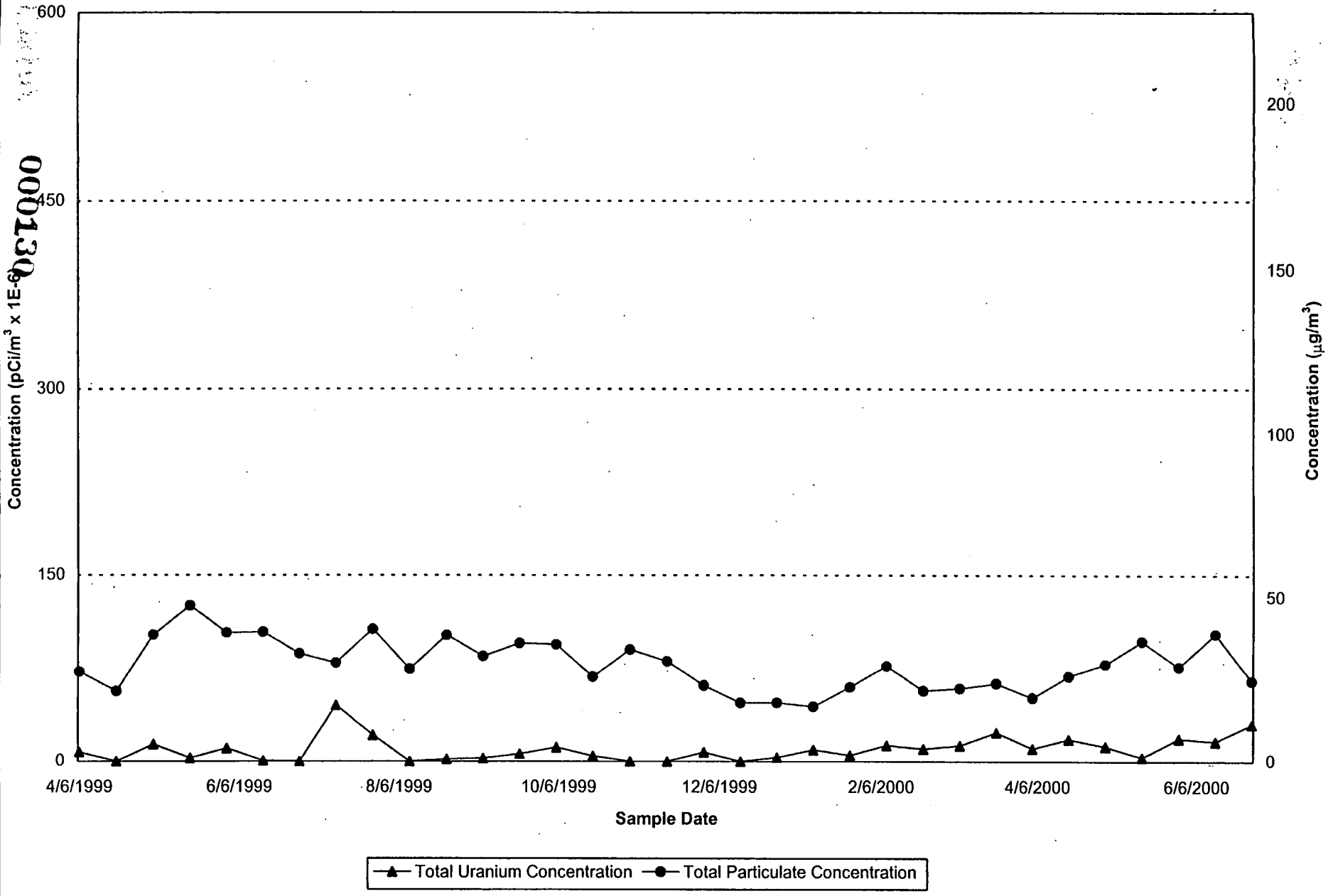


FIGURE 4-19. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-12)

FINAL

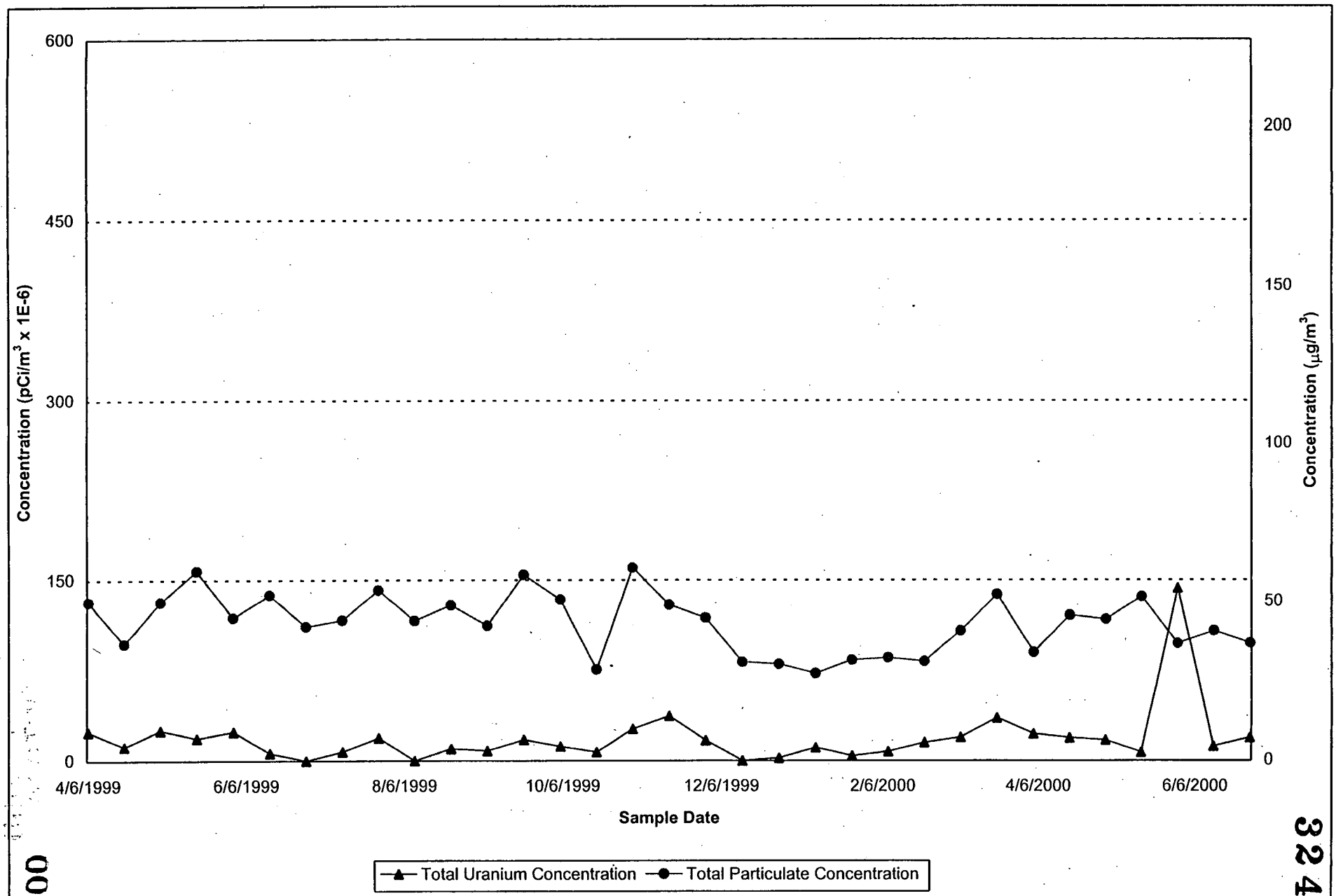


FIGURE 4-20. TOTAL URANIUM AND PARTICULATE CONCENTRATIONS IN AIR (AMS-16)

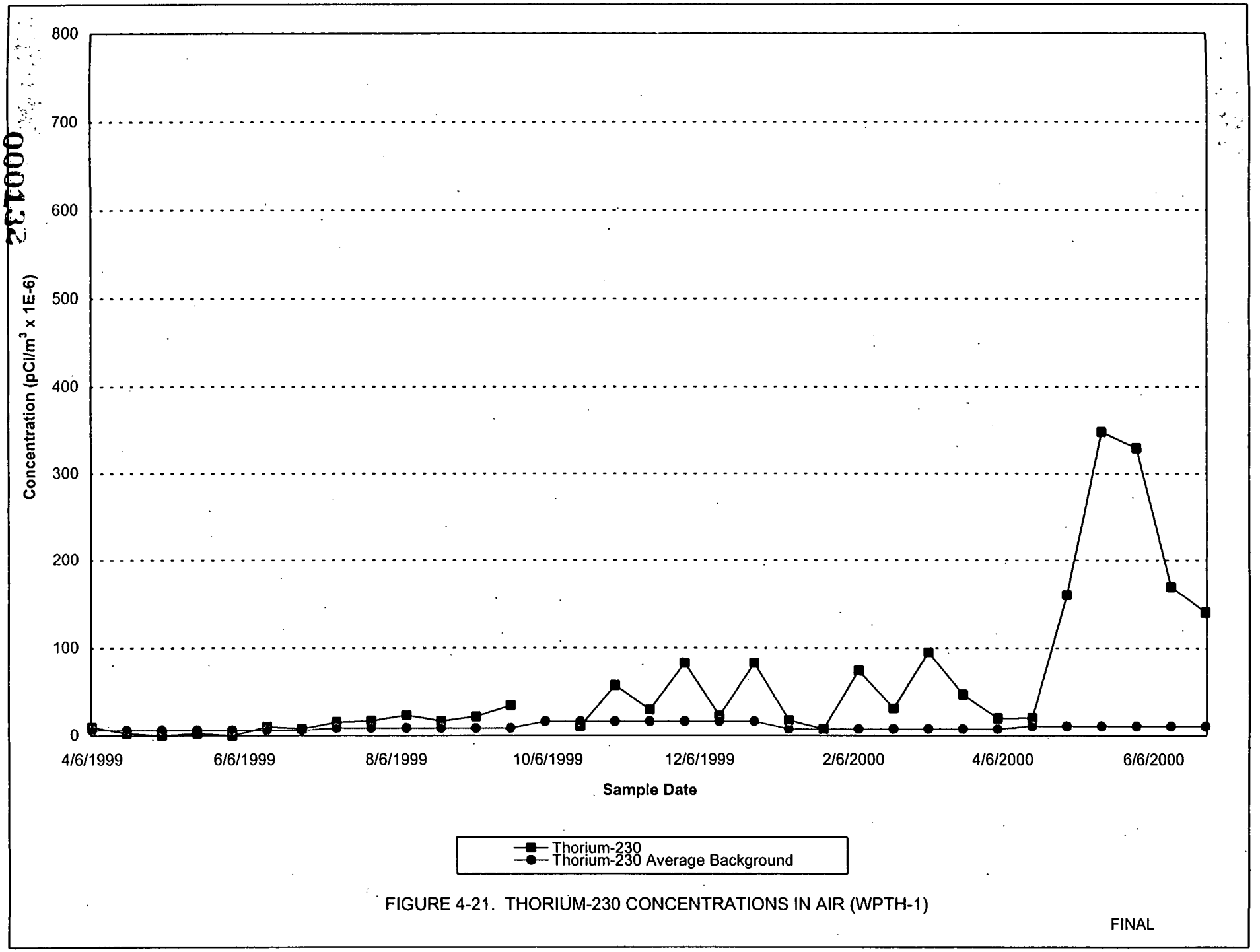


FIGURE 4-21. THORIUM-230 CONCENTRATIONS IN AIR (WPTH-1)

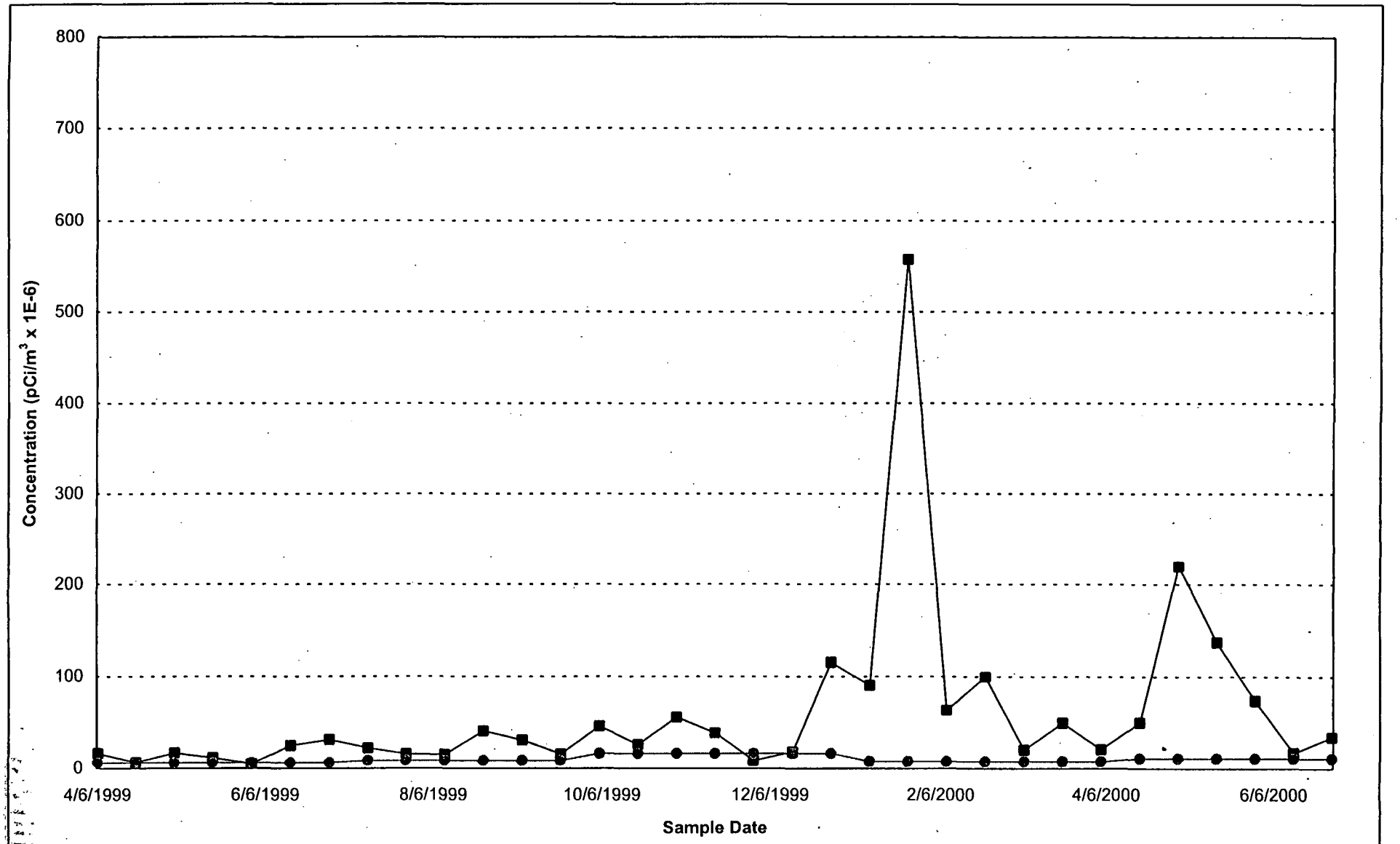


FIGURE 4-22. THORIUM-230 CONCENTRATIONS IN AIR (WPTH-2)

FINAL

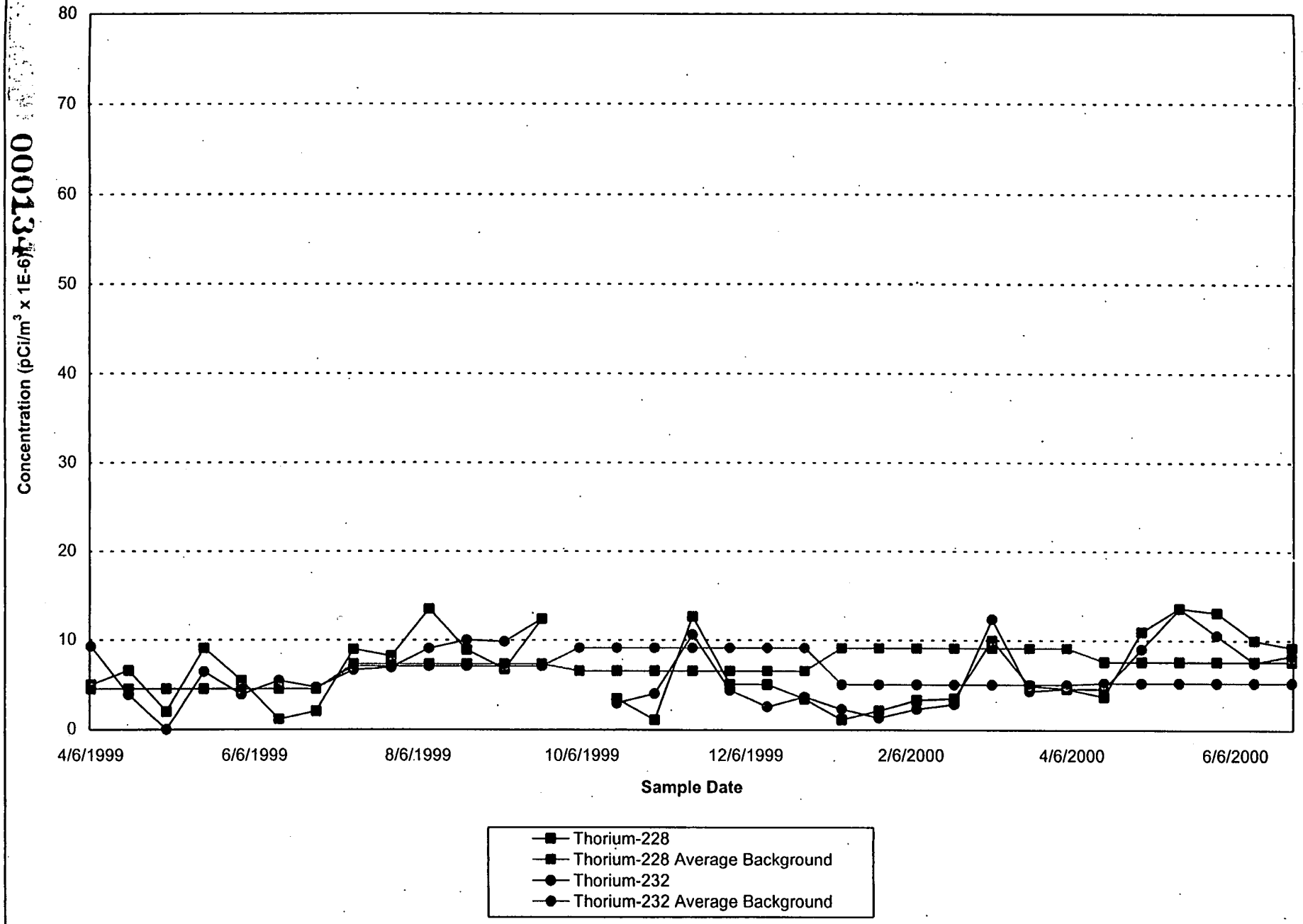


FIGURE 4-23. THORIUM-228 AND THORIUM-232 CONCENTRATIONS IN AIR (WPTH-1)

FINAL

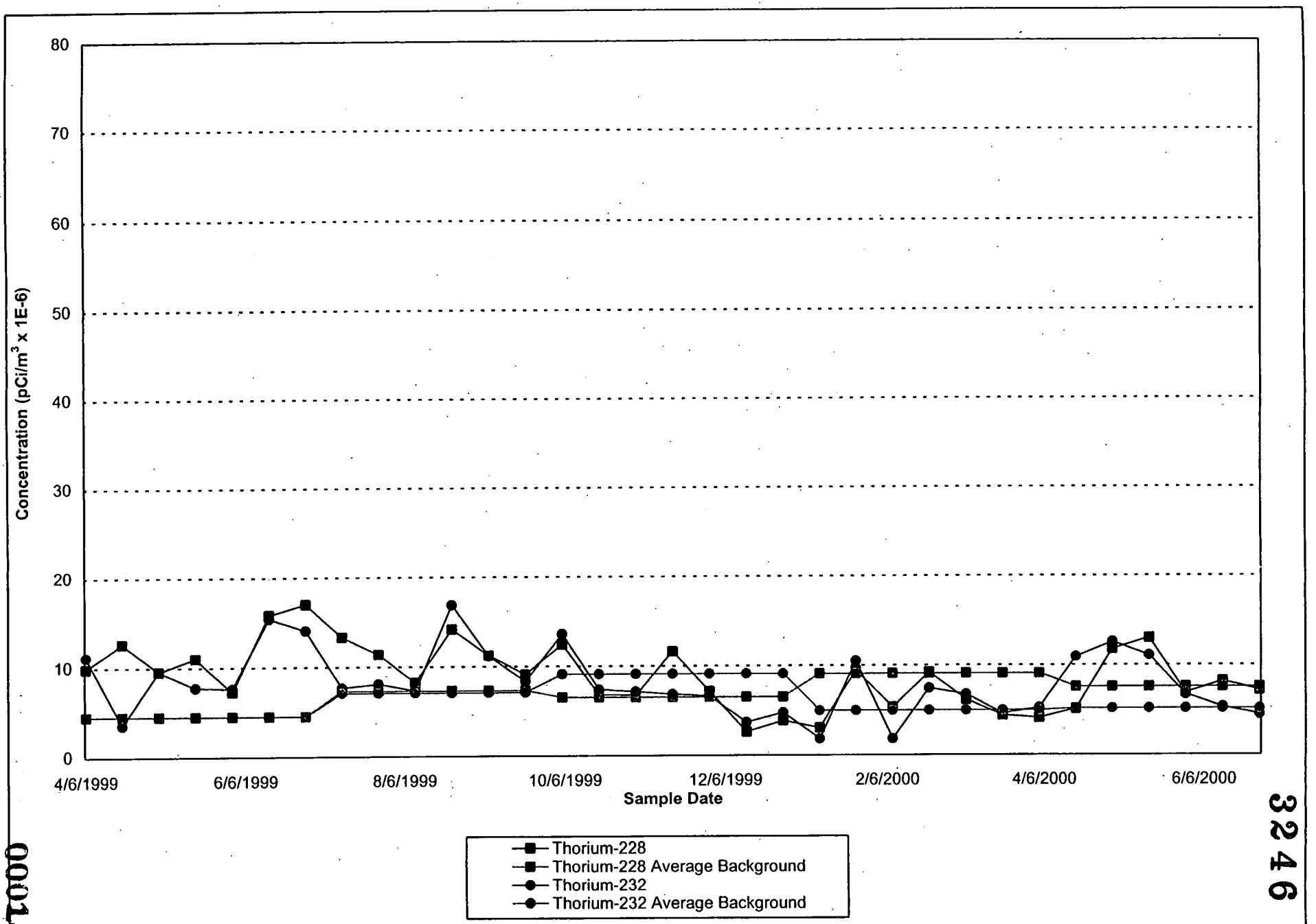
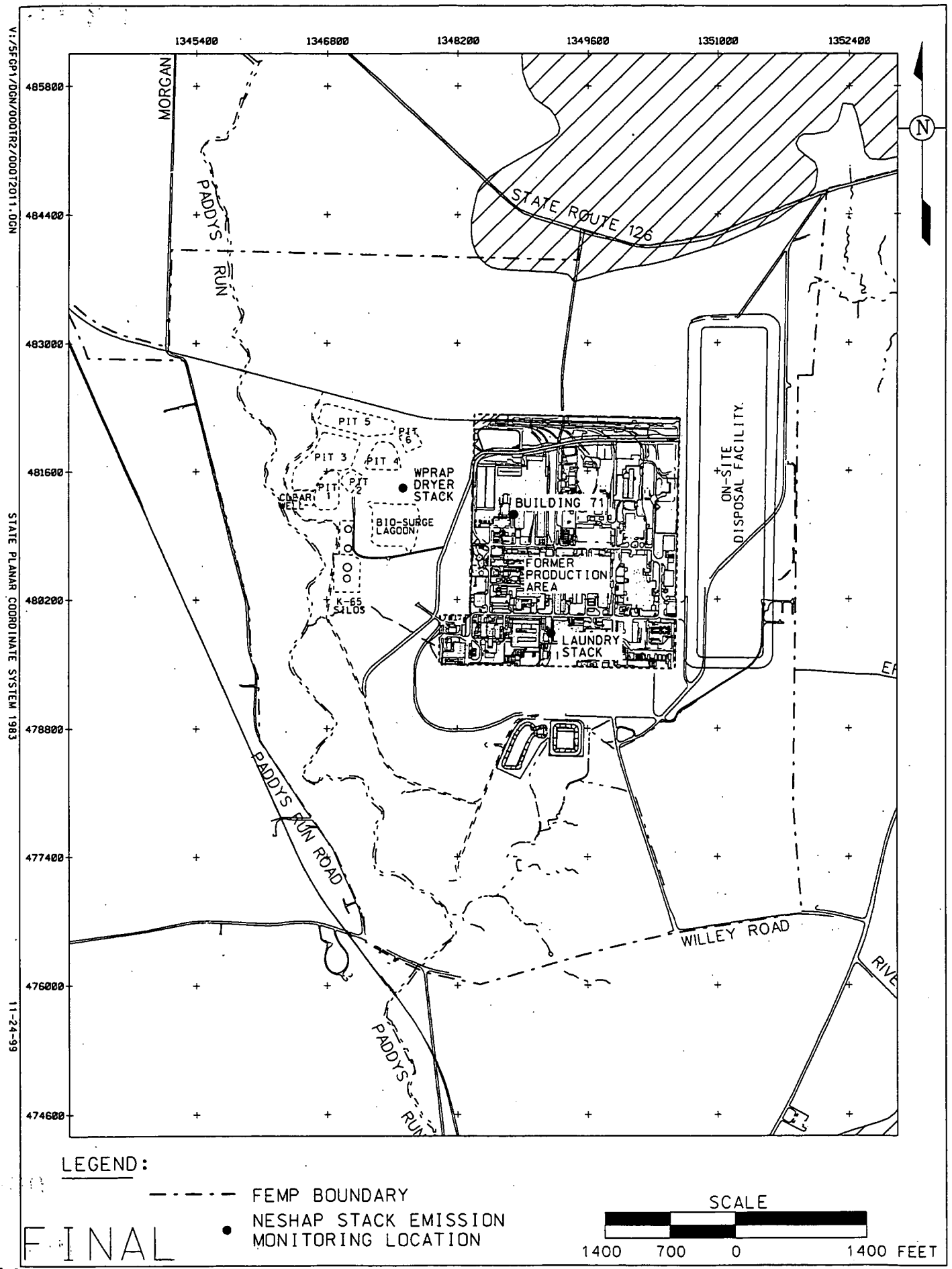


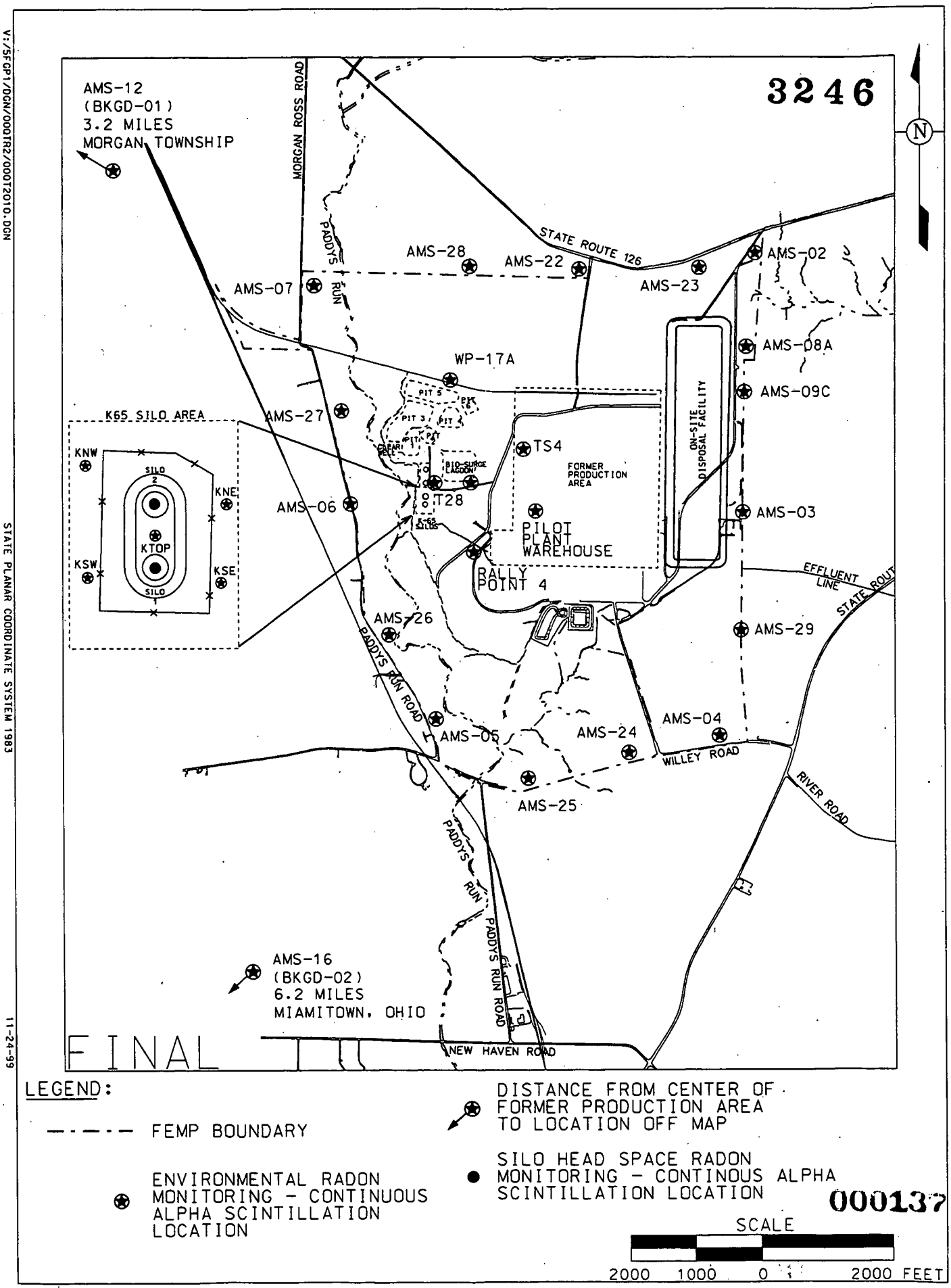
FIGURE 4-24. THORIUM-228 AND THORIUM-232 CONCENTRATIONS IN AIR (WPTH-2)



FINAL

000136

FIGURE 4-25. NESHAP STACK EMISSION MONITORING LOCATIONS

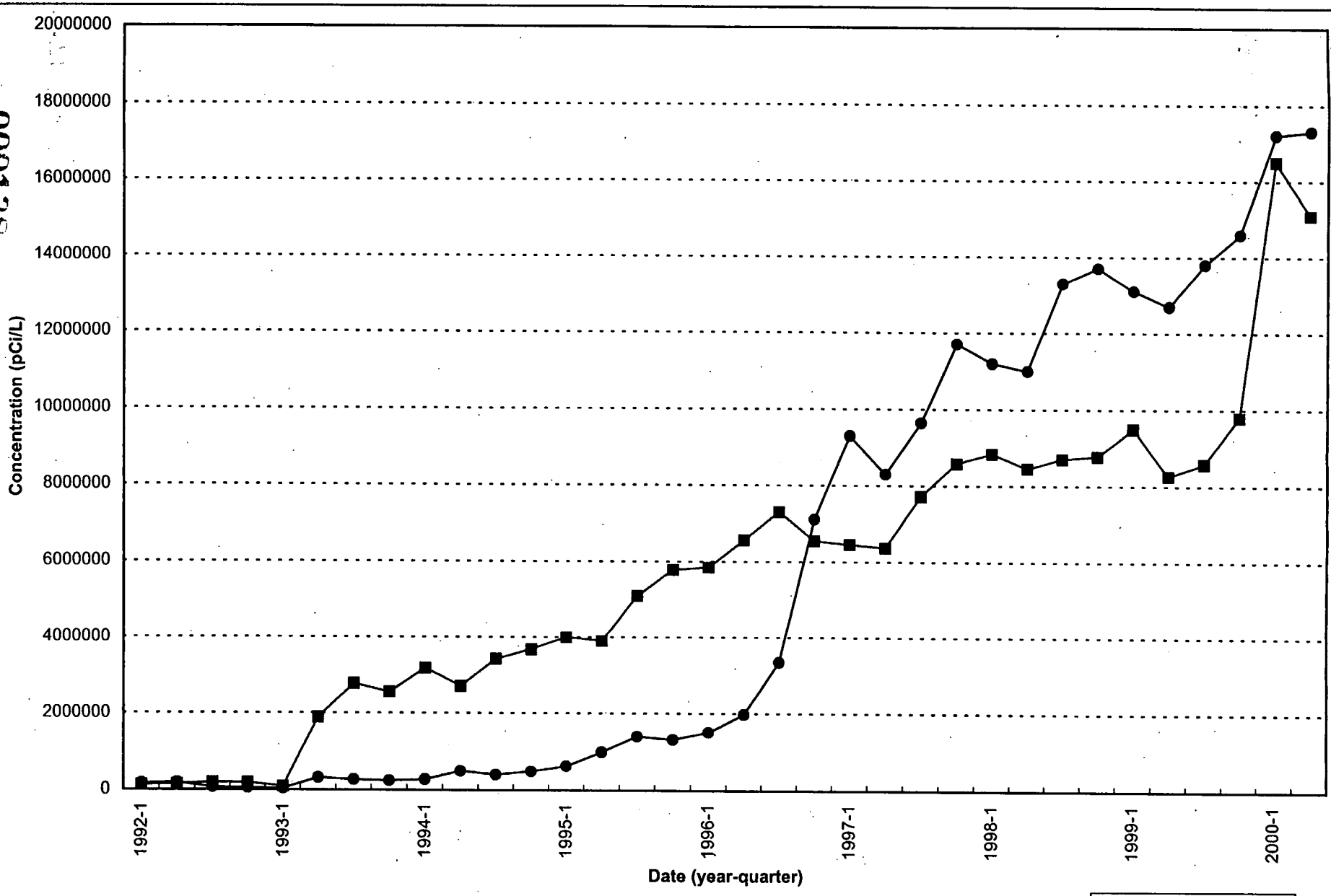


V:/5FGP1/DGN/000TR2/000T2010.DGN

STATE PLANAR COORDINATE SYSTEM 1983

11-24-99

FIGURE 4-26. RADON MONITORING - CONTINOUS ALPHA SCINTILLATION LOCATIONS

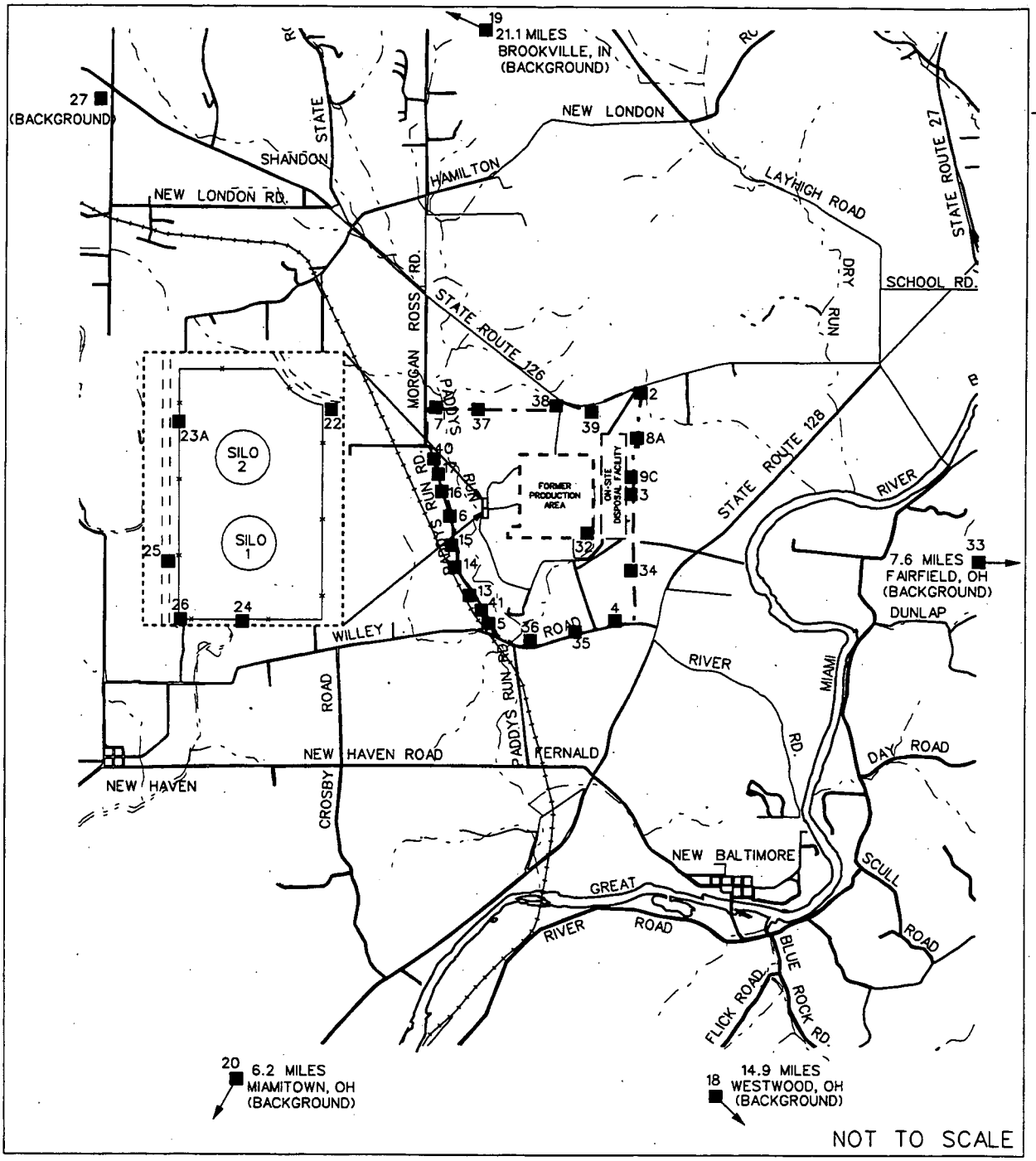


Note: 1) Defective sample line for Silo 1 was replaced during fourth quarter 1996.
2) Silo headspace correction was applied beginning with the first quarter of 2000.

Pre-Bentonite Levels:
Silo 1 ~ 26,000,000 pCi/L
Silo 2 ~ 30,000,000 pCi/L

FIGURE 4-27. QUARTERLY K-65 SILO HEADSPACE RADON CONCENTRATIONS, 1992 - 2000

FINAL



LEGEND:

DISTANCE FROM CENTER OF FORMER PRODUCTION AREA TO SAMPLE LOCATIONS OFF MAP

FEMP BOUNDARY

DIRECT RADIATION (TLD) MONITORING LOCATION

FINAL

000139

FIGURE 4-28. DIRECT RADIATION (THERMOLUMINESCENT DOSIMETER) MONITORING LOCATIONS

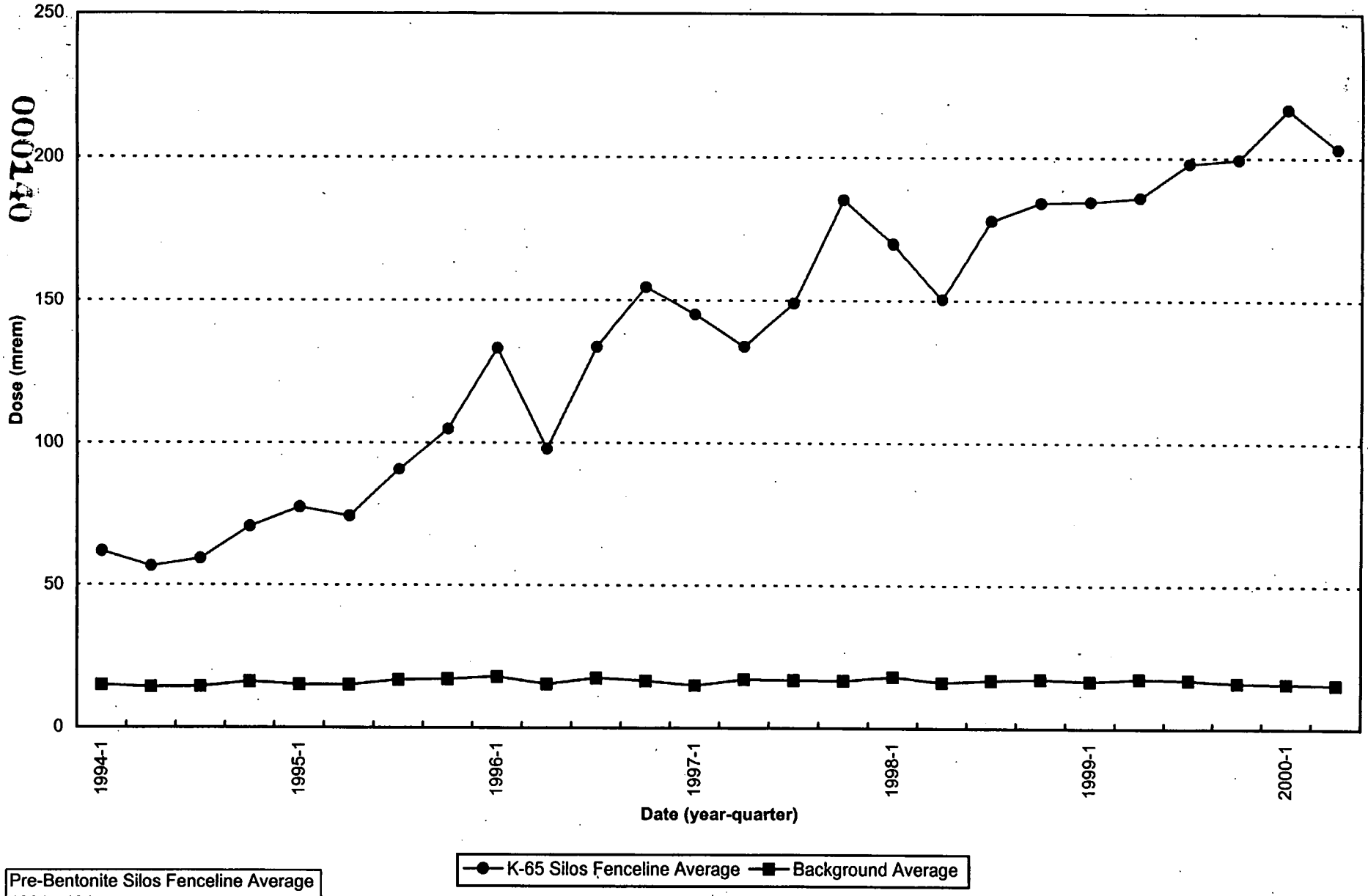


FIGURE 4-29. QUARTERLY DIRECT RADIATION (TLD) MEASUREMENTS, 1994 - 2000
(K-65 SILOS FENCELINE AVERAGE VERSUS BACKGROUND AVERAGE)

FINAL

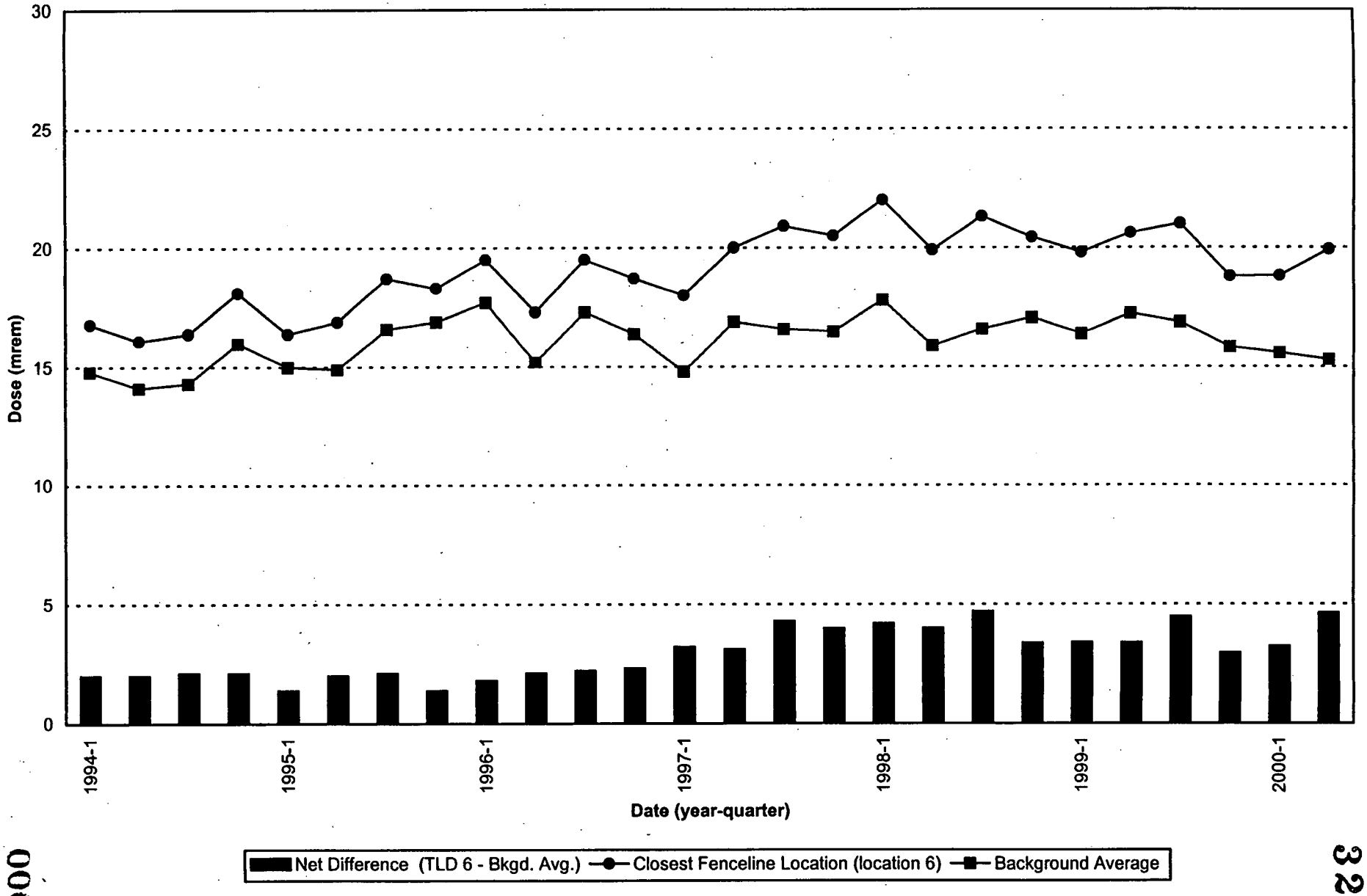


FIGURE 4-30. QUARTERLY DIRECT RADIATION (TLD) MEASUREMENTS, 1994 - 2000
(LOCATION 6 VERSUS BACKGROUND AVERAGE)

FINAL

Natural Resources

5.0 NATURAL RESOURCES

This section provides a summary of newly impacted or ecologically restored areas, as well as a status of wetlands and endangered species at the Fernald site.

The several habitat impacts that took place at the Fernald site during the second quarter of 2000 are discussed briefly below:

- Three acres of pasture grasses were cleared during remediation of the "radium hot spot" just south of the Storm Water Retention Basin. After grading work was completed, the area was reseeded with a wet marsh prairie grass and forb mix, and willow stakes were installed along the outfall. Currently, the effectiveness of this seeding is being evaluated and will be reported in the next quarterly status report.

- A power line relocation project in the vicinity of the waste pits resulted in the clearing of approximately 0.5 acre of small trees and underbrush along Paddys Run west of the waste pits. The area cleared was typical early-succession growth that consisted of box elder, sycamore, cottonwood, black locust, and honey locust in the canopy and amur honeysuckle, multiflora rose, willow, and grape vine in the understory. Originally, one utility pole was to be moved back from the vicinity of Paddys Run; however, this effort would have required extensive clearing of vegetation along the eastern bank of the stream. The removal of vegetation in this area could destabilize the bank and accelerate erosion. Therefore, an additional utility pole will be relocated in order to move the power lines away from existing vegetation. By moving this additional pole, disturbances along Paddys Run will be minimized.

- In preparation for the ground penetrating radar scan of the southwest fill area in Area 1, Phase III, approximately 0.5 acre of underbrush was cleared in this area. The impacts from this activity are minimal because the majority of the vegetation removed was the non-native, invasive shrub, amur honeysuckle.

- There was an inappropriate application of the pesticide diazanon around two air monitoring stations at the Area 1, Phase I Wetland Mitigation Project. Immediately after this problem was discovered, the diazanon was removed from the area. A subsequent field survey of benthic macroinvertebrates demonstrated that no impacts occurred to this population as a result of the pesticide. To prevent similar incidents from reoccurring, a more stringent review and approval process for field application of herbicides and pesticides has been implemented at the Fernald site. In addition, procedure EP-0008, Access to a Certified Area, was revised to incorporate restrictions on the use of pesticides and herbicides in certified (or restored) areas without the approval of Fernald Natural Resources personnel.

During the second quarter of 2000, work continued on the Area 8, Phase II Ecological Restoration Project with completion of the spring planting phase. Area 8, Phase II is a formerly grazed pasture located in the northwest corner of the Fernald site along Morgan-Ross Road in Butler County. Over 1,300 sapling trees were planted across the 18-acre site, resulting in the establishment of several habitats native to southwest Ohio, including beech-maple, oak-maple, and mesophytic forests, a tallgrass savanna, and the enhancement of the existing riparian corridor along Paddys Run. Also, several ponds and wetlands were constructed and planted with the appropriate wetland grasses and forbs. Bioengineering controls were used to repair cow paths that were accelerating erosion along the western bank of Paddys Run. In the fall of 2000, this project will be completed with the planting of approximately 475 shrubs and 2,300 seedlings across the area.

Several natural resources monitoring activities also continued during the second quarter of 2000, which are discussed below:

- At the Area 1, Phase I Wetland Mitigation Project, water elevations were measured in the ponds, water quality sampling continued, and mortality counts of vegetation planted during 1999 were initiated. The U.S. Department of Energy is required to replace vegetation if survival drops below 80 percent. Last year, a severe drought throughout the growing season impacted vegetation, and as a result, preliminary results of mortality counts indicate that some replacement planting will be required. The 2000 wetland monitoring data will be presented to the agencies in the annual Area 1, Phase I wetland mitigation monitoring report due out in late fall 2000.

- Monitoring by university researchers continued for each of the five ecological restoration research projects.

- Turbidity monitoring in Paddys Run as related to the state threatened Sloan's crayfish continued during the second quarter of 2000. This is discussed in Section 3.3 of this report, where it will continue to be presented in the future.

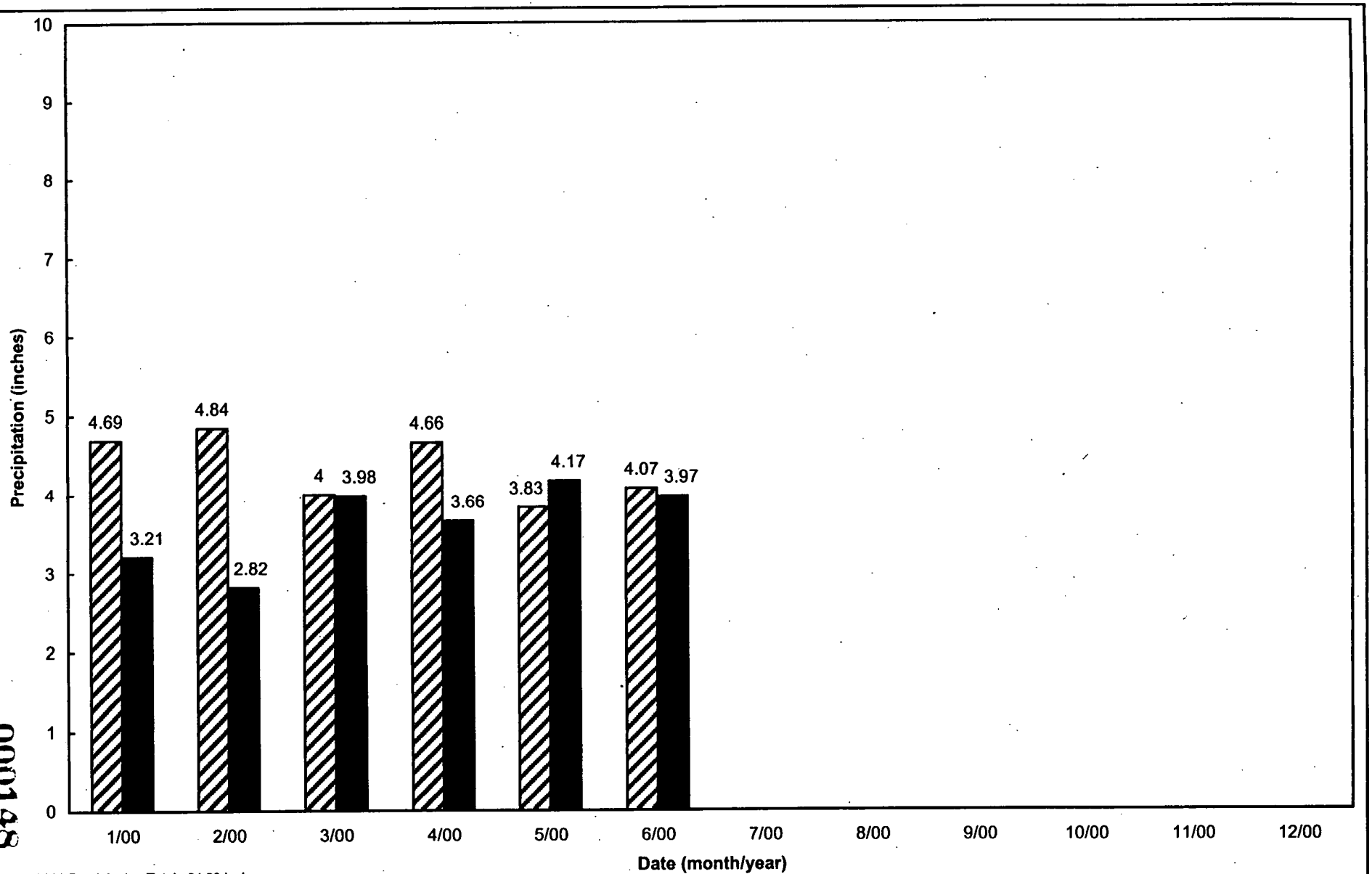
Meteorological

6.1 MONTHLY PRECIPITATION

This section provides the second quarter 2000 monitoring activities for the Integrated Environmental Monitoring Plan (IEMP) meteorological monitoring program. Figure 6-1 shows 2000 precipitation by month in the Fernald area compared to average precipitation by month from 1948 through 1997, based on data collected at the Greater Cincinnati/Northern Kentucky International Airport and at the Fernald site. Precipitation during the second quarter of 2000 was 12.56 inches, slightly higher than the average 11.8 inches for this time period.

6.2 WIND ROSE

This section provides the second quarter 2000 monitoring activities for the IEMP meteorological monitoring program. The second quarter 2000 wind rose (Figure 6-2) indicates that the predominant wind directions were from the southwest quadrant. The wind rose indicates that airborne emissions from site remediation activities would be carried towards air monitors along the northern and northeastern fenceline of the site. The second quarter wind rose is consistent with historical annual wind rose data for the Fernald area, which indicates that the predominant wind directions are from the southwest, which includes the south-southwest, southwest, and west-southwest sectors.

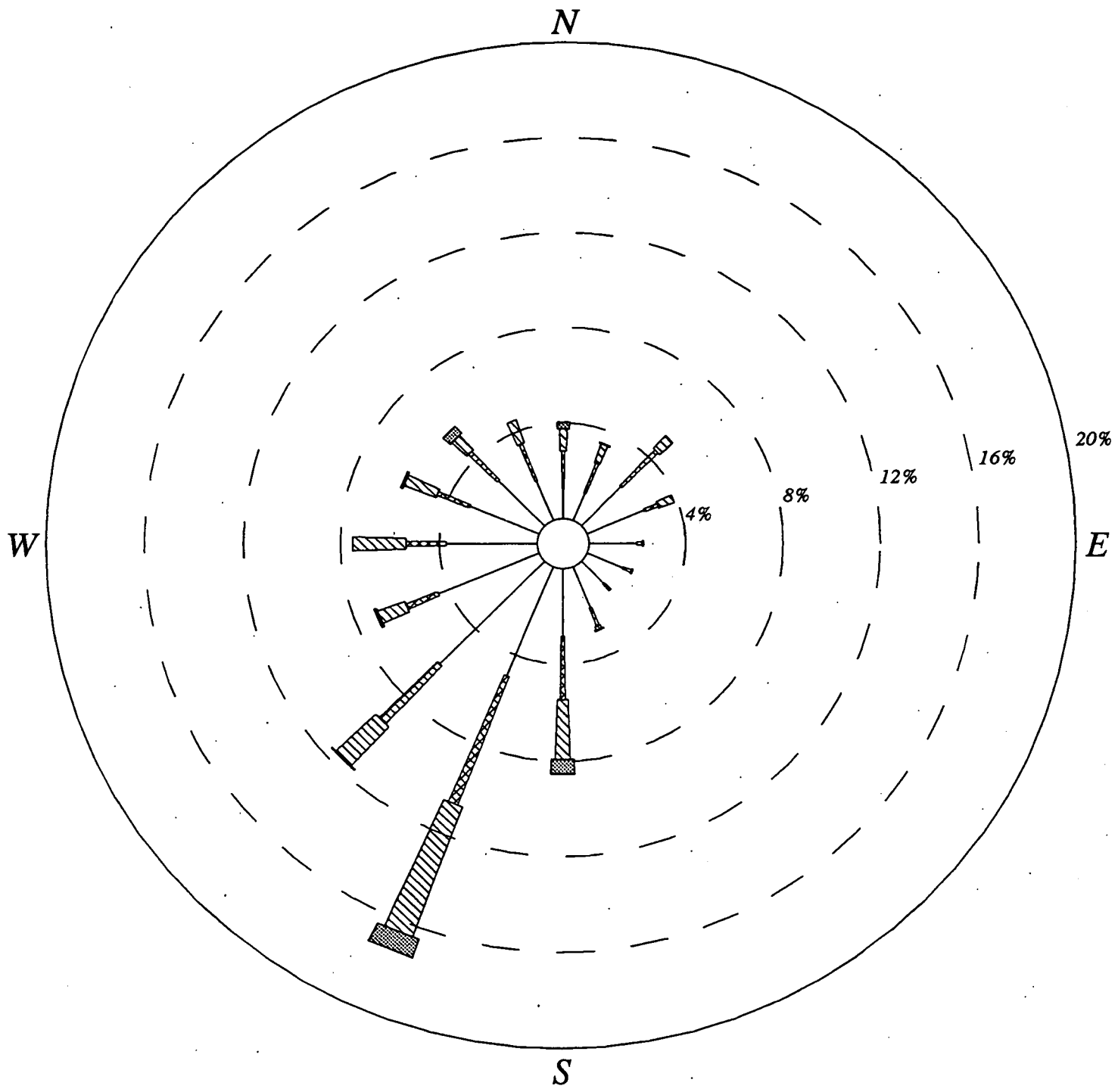


1999 FEMP Precipitation Total: 34.39 inches
Average Precipitation Total (1948 - 1997): 40.86 inches [a]

[a] Precipitation averages prior to 1993 are from the Greater Cincinnati/Northern Kentucky International Airport and averages after 1993 are from the FEMP.

FIGURE 6-1. 2000 FEMP MONTHLY PRECIPITATION DATA

FINAL



CALM WINDS 6.40%

WIND SPEED (KNOTS)

NOTE: Frequencies indicate direction from which the wind is blowing.

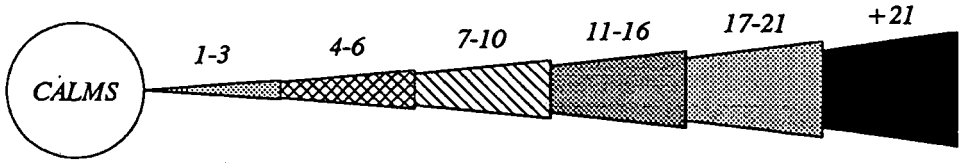


FIGURE 6-2. SECOND QUARTER 2000 WIND ROSE DATA, 10 METER HEIGHT

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